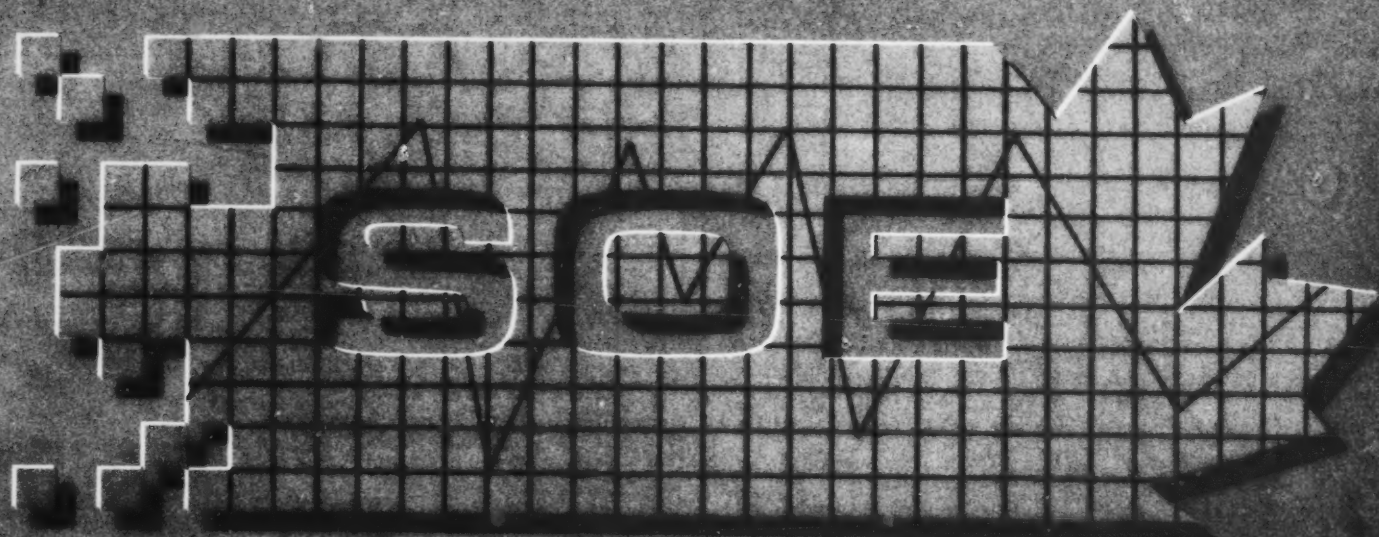


Environment Canada Environnement

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DEVELOPING A FEDERAL
ENVIRONMENTAL INDICATOR RESEARCH
NETWORK

Report No. 18

prepared for

Strategies and Scientific Methods Division

by

Gregg Sheehy

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Strategies and Scientific Methods
State of the Environment Reporting

Environment Canada
Technical Report No. 18

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1. INTRODUCTION

This report presents results of a project intended to develop a comprehensive framework of federal environmental indicator research. A considerable amount of work on indicators is being carried out by federal agencies, and much of the resulting information can be of value in state of the environment (SOE) reporting. An overall framework to inventory and categorize these efforts is required as a means to support and strengthen the scientific basis of the Canadian SOE Program.

The indicator research framework is described in Chapter 2. It is intended both as a broad outline within which current federal research can be categorized and a frame of reference to guide future research efforts in support of a continuing national SOE program.

The initial phase of this project involved: 1) developing a draft framework for review by Environment Canada's Sustainable Development and SOE Branch, and 2) developing a preliminary list of suggested contacts for a survey of federal managers responsible for programs likely to include environmental indicator research. Results were submitted to the SOE Branch in an interim report.

The second phase documented current indicator work (fleshing out the research framework developed in phase 1) and provided recommendations for future direction and priorities.

Following the SOE Branch's review of the interim report, the initial contact list was refined to include 24 senior managers. In consultation with these managers, a list was developed of 70 individuals to receive a questionnaire about indicator research activities. The two-part questionnaire requested general information about departments' indicator research programs (to be provided by program managers) and descriptions of individual research projects (to be provided by indicator researchers). A sample questionnaire is contained in Appendix I. Chapter 3 summarizes the results, and Appendix II presents detailed survey responses. Chapter 4 presents conclusions of the study. Chapter 5 is an action plan for a federal indicator research program.

Because of the large amount of indicator work described in this study, the reader may require assistance to identify projects in a particular subject area. Figure 1, on page 129, has therefore been provided as an aid in obtaining information on any of the 277 individual projects. The figure provides step-by-step instructions for searching the text and appendices.

2. INDICATOR RESEARCH FRAMEWORK

In developing the indicator research framework, it was important to reflect the dynamic nature of the biosphere and the important role which humans play in their environment. It was also recommended that a comprehensive set of state of the environment indicators must consider the cause and effect relationships among human activities, ecological processes and the condition of environmental media. The basic concept used to accommodate these needs was the stress-response principle which has guided much of the Canadian SOE work to date. This approach defines a number of agents of environmental change and documents environmental conditions in relation to these agents.

Gelinas and Slaats (1989) describe an organizational framework for SOE indicators based on the stress-response concept: Agents of change are subdivided into 1) human activities (waste generation, environmental restructuring, harvesting and depletion of non-renewable resources), and 2) natural processes (major events and major fluctuations). Environmental conditions are subdivided by 1) environmental assets/quantity (water and land resources, forests, fisheries, wildlife and non-renewables), and 2) environmental quality (including air, water, human health and exposure, and landscape). See Appendix III for the detailed breakdown of indicator categories.

Phase 1 of this study included an initial survey of federal responsibilities for environmental indicator research in the areas listed above. The scope of such work is vast, involving large numbers of staff within those departments having resource, regulatory, statistical and environmental responsibilities. To investigate specific indicator research projects in sufficient detail, it was seen as necessary to narrow the focus of the study. Therefore, in consultation with the SOE Branch, it was decided that the categories of indicator research to be investigated at this time are: waste generation, resource extraction, environmental assets and environmental quality. Table 1 presents the indicator framework based on these research categories.

In preparing a questionnaire for use in surveying federal environmental indicator researchers, the framework was used to define nine broad areas of research which are of interest:

1. the production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;

Table 1
Environmental indicator Research Framework

Indicator Category	Examples
<u>Human Activities</u>	
<u>Waste Generation</u>	
- mining and smelting	emissions, tailings production, effluent volumes
- manufacturing effluent discharges	emissions, waste generation
- municipal	sewage effluent discharge, waste landfilled/incinerated recycled
- energy	emissions, waste generation
- transportation	emissions, spills
<u>Harvesting</u>	
- fisheries	catches by species, fishery, zone; trends
- agriculture	yield by commodity and area; trends
- forestry	tree harvest by area, reforested areas; trends
- hunting and trapping	wildlife taken, by species, area; trends
<u>Depletion of Non-renewable Resources</u>	mineral/ore/fuel production by region, province
<u>Environmental Assets/Quantity</u>	
- water resources	supply quantity and area statistics

Table 1 (cont'd.)

Environmental indicator Research Framework

Indicator Category	Examples
<u>Environmental Assets/ Quantity (cont'd.)</u> - land resources - forests - fisheries - wildlife - non-renewable resources	supply quantity and area by classification supply quantity and age statistics population and stock size statistics population and location statistics mineral and location statistics
<u>Environmental Quality</u> - air - water (freshwater and marine) - food - human health and exposure - soil - precipitation	levels and trends in air pollutants by region/pollutant levels and trends in water polluting substances levels and trends of contaminants in foodstuffs toxic substance analysis in body tissues organic matter content, erosion rates, salinization, acidity acid deposition rates

Table 1 (cont'd.)

Environmental indicator Research Framework

Indicator Category	Examples
<u>Environmental Quality</u> (cont'd.) - fish and wildlife populations - forests - landscape	toxic substance analysis and trends, population dynamics, species diversity, endangered species, occurrence of lesions or disease forest depletion rate, logging, reforestation, species diversity, disease, pest and fire trends critical land conversions such as prime agricultural land, protected areas and reserves

3. rates of extraction of non-renewable natural resources;
4. the quantity and distribution of renewable resource stocks;
5. the size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; and
9. exposure of fish and wildlife to toxic chemicals.

The questionnaire was sent to 70 managers of federal programs considered likely to undertake research in one or more of the nine categories. The questionnaire, contained in Appendix I, requested general information about the managers' indicator research programs, with a separate description sheet to be filled out for each individual project. Responses to the questionnaire are detailed in Appendix II. Section 3 summarizes federal indicator research in relation to the indicator framework.

3. FEDERAL ENVIRONMENTAL INDICATOR RESEARCH

The survey of federal agencies demonstrated that there is a considerable amount of Canadian work related to environmental indicators. Tables 2 to 27 and Appendix II describe 277* individual projects within ten agencies. This can only be considered a sampling of the total number of indicator projects. It is virtually certain that there is other relevant activity which was missed by the survey. Of the 70 individuals surveyed, 66 (94%) responded. While some of those who did not respond may not have any projects relevant to SOE reporting, it is very likely that others do. Due to the broad scope of the indicator work being covered in this study, it is also likely that there are other researchers who were not reached by the survey.

Another likely reason that some of the federal indicator work would have been missed is the apparent reluctance of many managers and researchers to volunteer to participate in an SOE research network. Several of those interviewed

*To assist the reader in referencing the indicator research, each project has been assigned an identification number. Double counting of some of the projects required corrections in the numbering system, with the result that the highest number assigned to a project was 281, while there are in fact only 277 projects listed in the tables (certain numbers were not used). See Appendix V for a complete numerical listing of the projects.

expressed concern about the additional workload likely to be involved. Note also that many of those surveyed suggested other indicator research contacts as requested on the questionnaire. These contacts have not been followed up for this study, but many would be worth pursuing as the Sustainable Development and SOE Branch moves forward with its environmental indicator program.

It is important to point out that the scope of work described by the different survey respondents varies considerably. In some cases, an indicator "project" includes a number of different activities and large numbers of staff, while other "projects" are discrete, narrowly-focussed initiatives involving a single researcher.

The sections which follow summarize results of the survey, organized by the research categories from the indicator framework.

3.1 Human Activities: Waste Generation

Work on measures of waste generation by industries, consumers and the transportation sector is dominated by the Environmental Protection Directorate of Environment Canada (see Tables 2-6). The Inventory Management Division

provides Canada-wide information in its National Inventory of CO₂ (Project #2) and the Inventory of Common Pollutants (#3), while the Industrial Programs Branch conducts a number of focussed studies related to wastes and emissions from particular industries. Examples here are project #4, VOC Inventory from Chemical Plants, and #10, 1987 Status of Emission Controls of Pulp and Paper Mills. For SOE reporting purposes, projects #2 and #3 would provide useful input for national-level overview discussions of environmental pollution, while #4, #10 and many of the others would be most useful for highlighting issues related to specific sectors.

3.2 Human Activities: Harvesting

Fisheries and Oceans Canada has a major program in regulation of, and reporting on, fishing activity. A small portion of this work is described in Table 7. However, much of the harvesting information is used in the stock assessment work described in Table 15 (Environmental Assets--Fisheries). A very large mass of statistics is gathered by the DFO regional Science Directorates, and the information could be presented in a variety of formats for SOE reporting. See pages 124-138 of Statistics Canada (1986) for an example of a reporting format.

The Statistics Canada Census of Agriculture is a nationwide, continuing statistical program. Individual farmers are surveyed to obtain a variety of information on production of crops and livestock, as well as documenting trends in farm practices (cultivation methods, degree of mechanization, energy use, etc.). Data are aggregated at geographic scales from the local to national. Since the information is updated for each census year, this program can provide a good deal of useful ongoing input to SOE reporting (see Table 8). Statistics Canada (1986) illustrates the use of Census of Agriculture data in an SOE context.

The Forest Management Statistics component of Forestry Canada's FORSTATS Program (project #19, Table 9) compiles forest harvesting data as well as other silvicultural information for all the provinces and the territories. Information has been summarized in the periodic report series Silvicultural Statistics for Canada, most recently published as a summary of statistics for the period 1975-1986 (Kuhnke, 1989). The information is of sufficient detail for a national overview in an SOE reporting context. Combined with other FORSTATS information, project #19 can provide a good capsule picture of commercial forestry in Canada (see also Tables 14 and 26).

Federal activity related to wildlife harvesting statistics appears to be restricted essentially to migratory birds (the federal Migratory Birds Convention Act is administered by the Canadian Wildlife Service). CWS regional offices appear to take the lead role in carrying out relevant projects (see Table 10). The provinces have the primary responsibility for other species.

3.3 Human Activities: Depletion of Non-Renewable Resources

The National Energy Board describes trends in the consumption of fossil fuels in the Canadian Energy Supply and Demand report series (Table 11, project #21). Coupled with reserves information from Energy, Mines and Resources (see Table 17), these reports could be useful for SOE reporting in a major portion of the non-renewable resources sector. Other non-renewable resource information gathering activity could be expected from EMR, but were not reported by survey respondents. The Uranium and Nuclear Energy Branch in particular is involved here, but the branch has not completed a questionnaire, despite repeated requests.

3.4 Environmental Assets: Water

The Inland Waters Directorate of Environment Canada has a relatively large program to analyze water supply and water use in Canada. Of particular note here are the Water Survey of Canada (project #22), the Industrial Water Use Survey (#24) and the Municipal Water Use Survey (#25). See Table 12. The Water Survey compiles river flow, lake level and suspended sediment information for some 3000 sampling sites across Canada. The information is intended for users ranging from water resource managers to the general public. The Industrial Water Use Survey is conducted every five years, and the Municipal Survey every two to three years. Together these projects can provide very useful SOE information on national trends in water supply and demand.

3.5 Environmental Assets: Forests

The Forest Resource Dynamics component of Forestry Canada's FORSTATS Program (project #28, Table 14) provides a general national overview of additions and deletions to the "capital" of Canada's commercial forests due to insects, diseases, fire, logging and other causes.

3.6 Environmental Assets: Fisheries

Fisheries and Oceans Canada compiles abundant statistics on ocean fish populations, with somewhat less detailed information being available for freshwaters (where provinces share fisheries responsibilities with the federal government). Data are compiled by the regional Science Directorates, for several hundred discrete fish stocks.

DFO regional offices also conduct a variety of fish migration and life history studies as well as research on marine mammals. Table 15 illustrates the range of this indicator research.

The large amount of stock-by-stock data means that SOE reporting can be done at scales from the local to the national. However, as for most resource sectors, data collection concentrates on those species of commercial value.

3.7 Environmental Assets: Wildlife

The Canadian Wildlife Service conducts population studies on both game and non-game migratory birds, although the primary emphasis is on waterfowl (see Table 16). Thus for SOE reporting there will be significant data gaps for other species. The provinces should be able to provide some of

the needed information, although most population data will be for game animals.

3.8 Environmental Assets: Non-renewable Resources

Energy, Mines and Resources compiles data on reserves of petroleum and natural gas (Economic and Financial Analysis Branch), coal (National Coal Inventory, project #70), and uranium (Uranium and Nuclear Energy Branch--no response to the survey). See Table 17.

3.9 Environmental Quality: Air

The Atmospheric Environment Service is the key agency for air quality monitoring. The Canadian Air and Precipitation Monitoring Network (CAPMON, project #71, Table 18) compiles air and precipitation data gathered by AES regional offices. As well as this network, the AES has specific monitoring programs for carbon dioxide and ozone (projects 72-74).

The Inventory Management Division of the Environmental Protection Directorate uses AES data in its Analysis of Urban Air Quality Trends (project #75). Environmental Protection also maintains a data base for the

federal-provincial National Air Pollution Surveillance (NAPS) Network (project #273). NAPS monitors air quality in some 50 urban regions across the country.

In combination, these various sources could provide a good base for comprehensive SOE reporting of air quality.

3.10 Environmental Quality: Water

The Inland Waters Directorate has a large number of projects which would be suitable for a variety of SOE reporting uses (see Tables 12 and 19). These projects range from the broad scale Water Survey of Canada (project #22), to the Water Quality Indices project (#79), to the specialized studies conducted at the National Water Research Institute in Burlington. The latter include a study of nutrient/contaminant interactions in the Great Lakes (#7), sediment/water interactions (#88), groundwater contamination (#90) and air/water interactions (#92). For SOE reporting, the comprehensive IWD projects could provide national overview perspectives, while the special studies could be used to develop some very interesting special issue reports or specialized chapters within larger SOE reports.

3.11 Environmental Quality: Food

The Food Research Division of Health and Welfare Canada has three major projects which can provide broad indicators of human dietary exposure to hazardous substances: Total Diet Survey (project #96, Table 20), National Human Breast Milk Survey (#95) and General Monitoring of Selected Foods (#94). The Toxicology Research Division conducts such specialized research as a study of the toxicity of polychlorinated biphenyls to Rhesus monkeys (#100), analysis of shellfish toxins (#98) and a study of the teratogenic potential of certain chemicals (#99).

3.12 Environmental Quality: Human Health and Exposure

The Health Protection Branch of Health and Welfare Canada has a number of major projects related to human exposure to environmental hazards. These include studies of environmental radioactivity (#103, Table 21), indoor air quality (#103), Long Range Transport of Air Pollutants (#104), Industrial and Commercial Chemicals (#105), and analysis of drinking water supplies (#101). Results of this research should be well suited to issues-based SOE reporting.

3.13 Environmental Quality: Soil

Agriculture Canada is in the early stages of development of indicator projects which could be of considerable value for SOE reporting related to soil quality (see Table 22).

Project #244 is evaluating field monitoring procedures for five areas of soil degradation: erosion (wind and water), compaction, salinization, acidification, and loss of organic matter. Project #245 aims to develop improved methods of estimating soil erosion and determining the physical and chemical effects of erosion. The proposed project #246 is a broad program to provide nationally accepted standards for evaluating soil quality and a periodic assessment of the status of soil quality and degradation.

The Prairie Farm Rehabilitation Administration does some regional work in estimating wind and water erosion hazards based on surveys of crop residues (project #249).

3.14 Environmental Quality: Precipitation

The CAPMoN program of the Atmospheric Environment Service (project #71--Table 23) is the primary national data source on acid precipitation.

3.15 Environmental Quality: Fish Populations

The Department of Fisheries and Oceans conducts a wide variety of research on the condition of fish, marine mammals and their habitats (see Table 24). This work is carried out by the regional Science Directorates, and it includes:

- marine chemistry research (projects 89, 111, 114-120 and 141);
- studies of toxins and related diseases in fish (112, 125, 147, 148, 165 and 264);
- LRTAP and acidification studies (126-128, 138, 144, 146, 152, 164 and 166-170); and
- ecology and fish habitat research (108, 109, 110, 121, 124, 130, 135, 136, 137, 138, 140, 145, 151, 153, 157, 159, 172, 267 and 276)

Some of the DFO research aims specifically at development of SOE indicators:

- project #130, Using stable isotopes of carbon, nitrogen and sulfur as indicators of food web structure and migration patterns of fish;

- project #132, Biochemical Indicators of Chemical Effects on Fish;
- project #134, Indicateurs de toxicite dans le poisson; and
- project #139, Biochemical Indicator in Aquatic Ecosystems: Adenine Nucleotides.

The Fisheries and Oceans research could lend itself to SOE reporting in a variety of contexts (the above projects are only a sampling of the wide-ranging work which is being done).

3.16 Environmental Quality: Wildlife Populations

The Canadian Wildlife Service conducts a variety of studies on contaminants in migratory birds (Table 25). Projects include the Canada-wide, National Survey of Contaminants in Waterfowl (#176) and a number of regional and local studies (projects 177-179, 184, 185, 187-191, 196, 197, 204-206, 209, 211, 223, 224 and 226). Some of the studies specifically address impacts of pesticides on birds (projects 181, 182, 190, 197, 200, 203 and 226). This wide-ranging contaminants work could make an important

contribution to SOE reporting at the local to national scales.

The CWS regions are also involved to some extent in acid rain research (projects 215 and 222).

3.17 Environmental Quality: Forests

Forestry Canada's FORSTATS Program can provide broad, national-level indicators of the condition of Canadian forests, although the information relates only to commercial tree species in the southern portion of the country (the area where commercially desirable and economically accessible forests are found).

The Forest Inventory component of FORSTATS (Table 26, project #231) compiles data on the species and wood volumes of forests. The Forest Resource Dynamics Data component (#28) gives information on the gains to wood volume from tree growth and losses through logging, fire, insects and disease. The Forest Management Statistics component (#19) provides information on forestry activity--logging and silviculture. When combined with information from the Forest Insect and Disease Survey (project #232), the FORSTATS data can be used to judge the overall health of the forest, giving measures of resource stocks and the

human and natural forces which determine their conditions and trends.

3.18 Environmental Quality: Landscape

There seems to be very limited federal work in the area of SOE indicators for landscape quality (conversions of critical areas such as prime agricultural land, or ecological areas). The former Lands Directorate of Environment Canada was involved in this area. However, the only current national-level activity which was identified in this survey was project #26, Wildlife Habitat Conservation Strategy, an initiative begun by the Sustainable Development and SOE Branch at DOE (the project is now under the auspices of the Canadian Wildlife Service). The project, currently being developed, analyzes trends in habitat quality and quantity (see Table 27). For SOE reporting, this information might be best used as part of a general treatment of the state of wildlife, rather than as indicators of landscape quality or land use changes.

The Western and Northern Region of the CWS is also doing a regional study of effects on waterfowl habitat of land use change and climate change (project #256).

TABLES FOR CHAPTER 3

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH PROJECTS

Table 2

Indicator Research: Waste Generation--Mining and Smelting

<u>Agency Contact</u>	<u>Research Project (Identification Number)*</u>	<u>For Further Information</u>
Dr. L. Buffa Chief, Mining, Mineral and Metallurgical Processes Div. Industrial Programs Br. Environment Canada 13th Floor Place Vincent Massey Ottawa, Ontario K1A 0H3	Identification of metals released by 13 major metallurgical oper- ations (1)	Appendix II, page 163

953-1103

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Bill Moores Head, Chemical Processes Section Environmental Protection Environment Canada 4th Floor, Queen Square 45 Alderney Dr. Dartmouth, N.S. B2Y 2N6	Source Regulations--Toxic Substances (233)	App. II, p. 194
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*As an aid to cross-referencing, these numbers will be used throughout the text to identify indicator research projects.

Table 2 (cont'd.)

Indicator Research: Waste Generation--Mining and Smelting

<u>Agency Contact</u>	<u>Research Project (Identification Number)*</u>	<u>For Further Information</u>
F. Vena Chief, Inventory Management Div.	National Inventory of CO ₂ (2)	App. II, p. 187
Environmental Protection Environment Canada Place Vincent Massey Ottawa, Ontario K1A 0H3	Inventory of Common Pollutants (3)	App. II, p. 188
953-1656		

Table 3

Indicator Research: Waste Generation--Manufacturing

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
D.W. Bissett Chief, Chemical Industries Div. Industrial Programs Br. Environment Canada Ottawa, Ontario K1A 0H3 953-8257	VOC Inventory from Chemical Plants (4) Status Report on Compliance with the Chlor-alkali Mercury Regulations (5)	App. II, p. 149 App. II, p. 150
	Status Report on the Vinyl Chloride Industry (6)	App. II, p. 155
	Environmental Assessment of the Canadian Textile Industry (7)	App. II, p. 159
D.A. Bondy A/Chief, Zoology Div. National Museum of Natural Sciences P.O. Box 3443, Station D Ottawa, Ontario K1P 6P4 954-7676	Taxonomy and Ecology of Polychaete Worms (8)	App. II, p. 463

Table 3 (cont'd.)

Indicator Research: Waste Generation--Manufacturing

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
M. Guilcher Chief, Industrial and Shell- fish Programs Div. Environmental Protection Environment Canada 45 Alderney Dr. Dartmouth, Nova Scotia B2Y 2N6 902-426-6135	Industrial/Municipal Pollution (9)	App. II, p. 176
Bill Moores Head, Chemical Processes Section Environmental Protection Environment Canada 4th Floor, Queen Square 45 Alderney Dr. Dartmouth, N.S. B2Y 2N6 902-426-2004	Source Regulations--Toxic Substances (233)	App. II, p. 194

Table 3 (cont'd.)

Indicator Research: Waste Generation--Manufacturing

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
E.F. Muller Renewable Resources Extraction and Processing Div. Industrial Programs Br. Environment Canada Ottawa, Ontario K1A 0H3 953-1138	1987 Status of Emission Controls of Pulp and Paper Mills (10)	App. II, p. 183
Bill Ritchie Science Br., Gulf Region Department of Fisheries and Oceans P.O. Box 5030 Moncton, N.B. ELC 9B6 506-857-6230	Dioxin Program (263)	App. II, p. 296

Table 3 (cont'd.)

Indicator Research: Waste Generation--Manufacturing

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
F. Vena Chief, Inventory Management Div.	National Inventory of CO ₂ (2)	App. II, p. 187
Environmental Protection Environment Canada Place Vincent Massey Ottawa, Ontario K1A 0H3	Inventory of Common Pollutants (3)	App. II, p. 188
953-1656		

Table 4

Indicator Research: Waste Generation--Municipal

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
M. Guilcher Chief, Industrial and Shell- fish Programs Div. Environmental Protection Environment Canada 45 Alderney Dr. Dartmouth, Nova Scotia B2Y 2N6 902-426-6135	Industrial/Municipal Pollution (9)	App. II, p. 176
Bill Moores Head, Chemical Processes Section Environmental Protection Environment Canada 4th Floor, Queen Square 45 Alderney Dr. Dartmouth, N.S. B2Y 2N6 902-426-2004	Source Regulations--Toxic Substances (233)	App. II, p. 194

Table 4 (cont'd.)

Indicator Research: Waste Generation--Municipal

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
F. Vena Chief, Inventory Management Div.	National Inventory of CO ₂ (2)	App. II, p. 187
Environmental Protection Environment Canada Place Vincent Massey Ottawa, Ontario K1A 0H3	Inventory of Common Pollutants (3)	App. II, p. 188
953-1656		

Table 5

Indicator Research: Waste Generation--Energy Industries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
D.W. Draper Chief, Oil, Gas and Energy Div. Industrial Programs Br. Environment Canada 13th Floor Place Vincent Massey Ottawa, Ontario K1A 0H3	Control options for SO ₂ --Major Fossil Fuel Combustion Sources (11)	App. II, p. 165
	Control options for CO ₂ --Major Fossil Fuel Combustion Sources (12)	App. II, p. 166
	Control options for NO _x /VOC (13)	App. II, p. 167
Neil McIlveen Director, Energy and Fiscal Analysis Department of Energy, Mines and Resources 17th Floor 580 Booth St. Ottawa, Ont. K1A 0E4	Greenhouse Gas Emissions from Energy Use in Canada (236)	App. II, p. 33
995-5602		

Table 5 (cont'd.)

Indicator Research: Waste Generation--Energy Industries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Bill Moores Head, Chemical Processes Section Environmental Protection Environment Canada 4th Floor, Queen Square 45 Alderney Dr. Dartmouth, N.S. B2Y 2N6	Source Regulations--Toxic Substances (233)	App. II, p. 194

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App. II, p. 29

Environmental Geochemistry (14)

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Institute of Sedimentary and
Petroleum Geology
Energy, Mines and Resources
Canada
3303-33rd St., N.W.
Calgary, Alberta
T2L 2A7

403-292-7035

Table 5 (cont'd.)

Indicator Research: Waste Generation--Energy Industries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
F. Vena Chief, Inventory Management Div.	National Inventory of CO ₂ (2)	App. II, p. 187
Environmental Protection Environment Canada Place Vincent Massey Ottawa, Ontario K1A 0H3	Inventory of Common Pollutants (3)	App. II, p. 188
		953-1656

Table 6

Indicator Research: Waste Generation--Transportation

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Wayne Barchard Head, Marine Assessment Section Environmental Protection Atlantic Region Environment Canada 45 Alderney Dr. Dartmouth, NS. B2Y 2N6	Spill Trends Data Base (234)	App. II, p. 192

902-426-8304

36

Bill Moores Head, Chemical Processes Section Environmental Protection Environment Canada Dartmouth, N.S.	Source Regulations--Toxic Substances (233)	App. II, p. 194
	Fuels Regulations (235)	App. II, p. 195

902-426-2004

Table 6 (cont'd.)

Indicator Research: Waste Generation--Transportation

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
F. Vena Chief, Inventory Management Div.	National Inventory of CO ₂ (2)	App. II, p. 187
Environmental Protection Environment Canada Place Vincent Massey Ottawa, Ontario K1A 0H3	Inventory of Common Pollutants (3)	App. II, p. 188
953-1656		

Table 7

Indicator Research: Harvesting--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
W.G. Franzin Department of Fisheries and Oceans Central and Arctic Region 501 University Crescent Winnipeg, Manitoba R3T 2N6	High Arctic coastal fisheries for Arctic char (15)	App. II, p. 400
	Monitoring of the Lancaster Sound narwhal hunt (16)	App. II, p. 401
204-983-5082		

38

P. Thompson Manager, Commercial Analysis and Statistics Program Co-ordination and Economics Br. Department of Fisheries and Oceans Central and Arctic Region 501 University Crescent Winnipeg, Manitoba R3T 2N6	Economic analysis and studies to support regional fisheries planning and management (17)	App. II, p. 402
204-983-5227		

Table 8

Indicator Research: Harvesting--Agriculture

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J. Heimbecker Census of Agriculture Statistics Canada 12th Floor, Jean Talon Bldg. Tunney's Pasture Ottawa, Ontario K1A 0T6 951-3838	Census of Agriculture (18)	App. II, p. 478

Table 9

Indicator Research: Harvesting--Forestry

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Brian Haddon FORSTATS Coordinator Forestry Canada 20th Floor Place Vincent Massey Ottawa, Ontario K1A 1G5 997-1107	FORSTATS Program: Forest Management Statistics (19)	App. II, p. 416

Table 10

Indicator Research: Harvesting--Wildlife

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
W.H. Prescott A/Chief, Migratory Bird Management Atlantic Region Canadian Wildlife Service Environment Canada P.O. Box 1590 Sackville, N.B. EOA 3CO	Migratory Bird Management (Note that although Mr. Prescott was the only survey respondent who described a Migratory Bird Management project, each CWS region should have a similar program) (20)	App. II, p. 83

Table 11

Indicator Research: Depletion of Non-renewable Resources

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
David Collyer Director, Energy Supply Br. National Energy Board 473 Albert St. Ottawa, Ontario K1A 0E5 998-7952	Canadian Energy Supply and Demand report (21)	App. II, p. 456

Table 12

Indicator Research: Environmental Assets--Water Resources

<u>Agency Contact</u>	<u>Research Project</u> (<u>Identification Number</u>)	<u>For Further Information</u>
R.G. Lawford Chief, Hydrometeorology Research Div. National Hydrology Research Ctr. 11 Innovation Blvd. Saskatoon, Sask. S7N 3H5 306-975-5775	Use of Remotely Sensed Data in Hydrologic Models (270) Climatological and Hydrologic Variability and Change in the Red River Basin (271)	App. II, p. 239 App. II, p. 240

I. McLaurin
A/Chief, Water Survey of
Canada Div.
Water Resources Br.
Inland Waters Dir.
Environment Canada
8th Floor
Place Vincent Massey
Ottawa, Ontario
K1A 0H3

Water Survey of Canada (22)

App. II, p. 209

997-1474

Table 12 (cont'd.)

Indicator Research: Environmental Assets--Water Resources

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
P. Pilon Senior Hydrologist Water Resources Br. Inland Waters Dir. Environment Canada Place Vincent Massey Ottawa, Ontario K1A 0H3 953-1547	WMO Time Analysis of Long-Term Hydrometric Stations (analyzing the variability of streamflow) (23)	App. II, p. 211
D. Tate Socio-Economic Div. Water Planning and Management Br. Inland Waters Dir. Ottawa 953-3478	Industrial Water Use Survey (24) Municipal Water Use Survey (25)	App. II, p. 212 App. II, p. 213

Table 13

Indicator Research: Environmental Assets--Land Resources

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
G. Lee Chief, Habitat and Land Use Canadian Wildlife Service Environment Canada Ottawa, Ontario K1A 0H3 953-1434	Wildlife Habitat Conservation Strategy (26)	App. II, p. 44
E. Wiken Chief, Ecological Applications Research Div. Sustainable Development and SOE Branch 997-1090	Ecological Resource Data Bases (ecozones; ecoprovinces, ecoregions; ecodistricts; ecoclimatic provinces and regions) (27)	App. II, p. 244

Table 14

Indicator Research: Environmental Assets--Forests

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Brian Haddon FORSTATS Coordinator Forestry Canada 20th Floor Place Vincent Massey Ottawa, Ontario K1A 1G5	FORSTATS Program: Forest Resource Dynamics Data (28)	App. II, p. 418
997-1107		

Table 15

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
K.T.J. Chang-Kue Resource Impact/Habitat Biologist Freshwater Inst. Department of Fisheries and Oceans 501 University Crescent Winnipeg, Manitoba R3T 2N6	Coastal Coregonid Migrations (29)	App. II, p. 380
J.C. Davis Regional Director, Science Pacific Region Institute of Ocean Sciences Department of Fisheries and Oceans P.O. Box 6000 9860 West Saanich Rd. Sidney, B.C. V8L 4B2 604-356-6515	Resource Assessment and Related Research--Salmon Production (277) Resource Assessment and Related Research--Groundfish (278) Resource Assessment and Related Research--Herring (279) Resource Assessment and Related Research--Shellfish (280)	App. II, p. 409 App. II, p. 410 App. II, p. 412 App. II, p. 411

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. R. Elner Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-3246	Cape Breton crab assessments and research (30)	App. II, p. 260
W.G. Franzin Department of Fisheries and Oceans Central and Arctic Region 501 University Crescent Winnipeg, Manitoba R3T 2N6 204-983-5082	Arctic Cisco 1 Migrations and Life History (31)	App. II, p. 404

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project</u> (<u>Identification Number</u>)	<u>For Further Information</u>
A.H. Kristofferson Fishery Management Biologist Department of Fisheries and Oceans Central and Arctic Region 204-983-5159	Fish and Marine Mammal Management: Coastal Fisheries (32)	App. II, p. 390
M. Kingsley Chef, Division des mammifères marins et de la parasitologie Maurice Lamontagne Inst. Department of Fisheries and Oceans P.O. Box 1000 Mont-Joli, Quebec C5H 3Z4 418-775-6787	Great whales (33) Odontocete research (34) Gulf pinniped ecology research (35) Arctic pinnipeds (36)	App. II, p. 321 App. II, p. 322 App. II, p. 323 App. II, p. 324

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
P. Lawton Aquaculture and Invertebrate Fisheries Div. Department of Fisheries and Oceans Biological Station St. Andrews, N.B. EOG 2XO	Lobster stock assessment (37)	App. II, p. 261
	Lobster research: juvenile and adult field studies (38)	App. II, p. 262

M. Mercer Regional Director, Science Newfoundland Region Department of Fisheries and Oceans P.O. Box 5667 St. John's, Nfld. A1C 5X1	biological studies and assessments for groundfish (39)	App. II, p. 248
	biological studies and assessments for pelagic fish, shellfish and marine mammals (40)	App. II, p. 250
709-772-2027	biological studies and assessments for freshwater and anadromous fish (41)	App. II, p. 251

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. R. Miller Bedford Institute 506-529-4517	Lobster assessments and related research (42)	App. II, p. 263
H.B. Nicholls Head, Marine Assessment and Liaison Div. Bedford Institute 506-529-4517	Grey and harbour seal assessment and ecology (43)	App. II, p. 264
	Fish stock assessment and ecology (44)	App. II, p. 265
P. Richard Marine Mammal Management Biologist Department of Fisheries and Oceans Central and Arctic Region 204-983-5162	Assessment of beluga, narwhal and walrus populations (distribution and abundance) in relation to their use (45)	App. II, p. 394

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Bill Ritchie Science Br., Gulf Region Department of Fisheries and Oceans P.O. Box 5030 Moncton, N.B. ELC 9B6 506-857-6230	fisheries advice (265) improving survey methods (266) research on fish recruitment and distribution (268)	App. II, p. 298 App. II, p. 299 App. II, p. 301

G. Robert
Marine Assessment
and Liaison Div.
Bedford Institute
506-529-4517

Scallop assessment and research (46) App. II, p. 266

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
S.M.C. Robinson Department of Fisheries and Oceans Biological Station St. Andrews, N.B. EOG 2XO 506-529-4517	Soft-shell clam ecology and fish- ery research (47) Scallop population dynamics and fishery research (48)	App. II, p. 267 App. II, p. 268
M. Roddick Bedford Institute 506-529-4517	Offshore clam assessments and research (49)	App. II, p. 269
T.W. Rowell Habitat Ecology Div. Bedford Institute 506-529-4517	Inshore clam stock assessment and related research (50)	App. II, p. 275

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
A. Sinclair Chef, Division de la recherche sur les pêches Department of Fisheries and Oceans Quebec Region 418-775-6643	Biological studies and stock assessments for various fish species (51)	App. II, p. 327
J.T. Strong Marine Mammals Management Biologist Department of Fisheries and Oceans Central and Arctic Region 204-993-5162	Beaufort Sea Beluga Project (52) Lancaster Sound Narwhal Project (53)	App. II, p. 398 App. II, p. 399

Table 15 (cont'd.)

Indicator Research: Environmental Assets--Fisheries

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J.C. Therriault Chef, Division de l'oceanographie biologique Department of Fisheries and Oceans Quebec Region 418-775-6595	Communautés ichtyoplanctoniques dans le Golfe Saint-Laurent: Associations multispecifiques et interactions trophiques (54)	App. II, p. 362
	Alimentation et distribution de larves de Sebaste par rapport à la productivité du copepode plancton- ique, <u>Calanus finmarchicus</u> (55)	App. II, p. 363

Table 16

Indicator Research: Environmental Assets--Wildlife

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
L.N. Carbyn Research Scientist Canadian Wildlife Service Western and Northern Region 4999---98 Ave. Edmonton, Alta. T6B 2X3 403-435-7357	Large Mammal Systems Studies in Riding Mountain National Park (262)	App. II, p. 146
H. Loney Dickson Wildlife Biologist-- Shorebirds Canadian Wildlife Service Western and Northern Region Edmonton 403-468-8917	Prairie/NWT Shorebird Program (261)	App. II, p. 144

Table 16 (cont'd.)

Indicator Research: Environmental Assets--Wildlife

<u>Agency Contact</u>	<u>Research Project</u> (<u>Identification Number</u>)	<u>For Further Information</u>
George S. Hochbaum Population Regulation Biologist Canadian Wildlife Service 501 University Crescent Winnipeg, Man. R3T 2E2	Population Mortality Program (259) Central Arctic Goose Survival (260)	App. II, p. 141 App. II, p. 142
C. Hyslop Coordinator, Nongame Birds and Latin American Program Canadian Wildlife Service Ottawa, Ontario K1A 0H3	Data base on Nongame Migratory Bird Populations (56)	App. II, p. 46
Frank L. Miller Research Scientist Canadian Wildlife Service Western and Northern Region Edmonton	Peary Caribou Conservation (252)	App. II, p. 131

403-468-8927

Table 16 (cont'd.)

Indicator Research: Environmental Assets--Wildlife

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
R. Pratt Chief, Migratory Birds Conservation Ontario Region Canadian Wildlife Service Environment Canada 1725 Woodward Dr. Ottawa, Ontario K1A 0H3 952-0932	Colonial Waterbirds of the Great Lakes Basin (57)	App. II, p. 86 111
	Ontario Waterfowl Population Assess- ment (58)	App. II, p. 112
	Status of migratory birds (song- birds) (59)	App. II, p. 113
W.H. Prescott A/Chief, Migratory Bird Management Atlantic Region Canadian Wildlife Service Environment Canada P.O. Box 1590 Sackville, N.B. EOA 3C0 506-536-3025	Non-Game Bird Surveys (60)	App. II, p. 84
	Duck Population Monitoring (61)	App. II, p. 85
	Harlequin and Peregrine Surveys-- Labrador (62)	App. II, p. 86
	Shorebird Banding in the Bay of Fundy (63)	App. II, p. 87

Table 16 (cont'd.)

Indicator Research: Environmental Assets--Wildlife

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
W.H. Prescott (cont'd.)	Monitoring Population Trends and Breeding Performance of Seabirds in Atlantic Waters (64)	App. II, p. 88
	Black Duck Research (65)	App. II, p. 89
Dr. George Scotter Chief, Wildlife Conservation and Research Div. Canadian Wildlife Service Western and Northern Region Edmonton	Loggerhead Shrike Conservation (253)	App. II, p. 133
	Integration of Migratory Bird and Timber Management (254)	App. II, p. 134
	Remote Sensing Studies (255)	App. II, p. 135
Dr. Ian Stirling Wildlife Conservation and Research Div. Canadian Wildlife Service Western and Northern Region Edmonton	Polar Bear Ecology (250)	App. II, p. 127

403-468-8927

Table 16 (cont'd.)

Indicator Research: Environmental Assets--Wildlife

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
D.C. Thomas Research Scientist Canadian Wildlife Service Western and Northern Region Edmonton 403-468-8927	Effects of Forest Fires on the Winter Range of the Beverly Herd of Barren-Ground Caribou (251)	App. II, p. 129
Robert Trottier Director, Biosystematics Research Ctr. Agriculture Canada Ottawa, Ont. K1A 0C6 996-1665	Plant 'Gene Resource (238) Economic Plants (239) Economic Fungi (240) Soil and Water Organisms (241) Beneficial Insects (242) Insect Pests (243)	App. II, p. 7 App. II, p. 8 App. II, p. 9 App. II, p. 10 App. II, p. 11 App. II, p. 12

Table 16 (cont'd.)

Indicator Research: Environmental Assets--Wildlife

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
S. Wetmore Chief, Migratory Birds Pacific and Yukon Region Canadian Wildlife Service P.O. Box 340 Delta, B.C. V4K 3Y3	Seabird colony inventory (66)	App. II, p. 118
	Waterfowl breeding pair survey (67)	App. II, p. 119
604-946-8546		

Table 17

Indicator Research: Environmental Assets--Non-renewable Resources

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
R. Conn Manager, Petroleum Resources Economic and Financial Analysis Energy, Mines and Resources Canada	Western Basin Natural Gas Study (68)	App. II, p. 26
580 Booth St. Ottawa, Ontario K1A OE4	Mackenzie Delta/Beaufort Sea Economic Analysis (69)	App. II, p. 27

992-1194

62

J.D. Hughes
Coal Geologist
Geological Survey of Canada
3303-33rd St., N.W.
Calgary, Alberta
T2L 2A7
403-284-0110

National Coal Inventory for Canada
(70)
App. II, p. 31

Table 18

Indicator Research: Environmental Quality--Air

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
T. Dann Head, Air Toxics River Road Environmental Technology Ctr. Environment Canada Ottawa K1A 0H3 991-9459	National Air Pollution Surveillance (273)	App. II, p. 201
Lawrence King Project Officer Environment Canada Conservation and Protection Ontario Region Ottawa, District Office 49 Camelot Dr. Nepean, Ont. K1A 0H3 952-8679	Cornwall Island Fluoride Monitoring (269)	App. II, p. 199

Table 18 (cont'd.)

Indicator Research: Environmental Quality--Air

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
R.G. Lawford Chief, Hydrometeorology Research Div. National Hydrology Research Ctr. 11 Innovation Blvd. Saskatoon, Sask. S7N 3H5 306-975-5775	General Circulation Model Verification (272)	App. II, p. 241
S. McNair Atmospheric Environment Service Environment Canada 4905 Dufferin Street Downsview, Ontario M3H 5T4 416-739-4980	Canadian Air and Precipitation Monitoring Network (CAPMON) (71)	App. II, p. 39

Table 18 (cont'd.)

Indicator Research: Environmental Quality--Air

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Bill Moores Head, Chemical Processes Section Environmental Protection Environment Canada 4th Floor, Queen Square 45 Alderney Dr. Dartmouth, N.S. B2Y 2N6	LRTAP Monitoring--Oxidants (237)	App. II, p. 196
M.E. Still Head, Air Quality Services Liaison Office Atmospheric Environment Service Downsview, Ontario 416-739-4866	Carbon Dioxide Monitoring (72) Tropospheric Ozone Monitoring (73) Stratospheric Ozone Monitoring (74)	App. II, p. 40 App. II, p. 41 App. II, p. 42

Indicator Research: Environmental Quality--Air

66

Table 19

Indicator Research: Environmental Quality--Water

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
S. Beltaos Rivers Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	River Modelling Project (76)	App. II, p. 216
J.H. Carey Lakes Research Br. National Water Research Inst.	Nutrient/Contaminant Interactions Project (77)	App. II, p. 218
M.N. Charlton Lakes Research Br. National Water Research Inst.	Lakes Restoration Project (78)	App. II, p. 220

Table 19 (cont'd.)

Indicator Research: Environmental Quality--Water

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J.C. Davis Regional Director, Science Pacific Region Institute of Ocean Sciences Department of Fisheries and Oceans P.O. Box 6000 9860 West Saanich Rd. Sidney, B.C. V8L 4B2	Environmental Contaminants and Aquatic Chemistry (274) Ocean Climate Chemistry (275)	App. II, p. 406 App. II, p. 407
604-356-6515		

58

Adrian Demayo Chief, Water Quality Assessments Inland Waters Dir. Environment Canada 7th Floor Place Vincent Massey Ottawa, Ontario K1A 0H3	Water Quality Indices (79)	App. II, p. 204
997-1921		

Table 19 (cont'd.)

Indicator Research: Environmental Quality--Water

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
B.J. Dutka Rivers Research Br. National Water Research Inst.	Ecotoxicology Project (80)	App. II, p. 222

W. Ernst
Head, Pesticides and
Ecological Effects
Environmental Protection
Environment Canada
15th Floor, Queen Square
45 Alderney Dr.
Dartmouth, Nova Scotia
B2Y 2N6

Measurement of impacts of pest-
icides/toxic chemicals (81)

App. II, p. 168

902-426-6141

M. Guilcher
Chief, Industrial and Shell-
fish Programs Div.
Environmental Protection
Environment Canada
Dartmouth

Shellfish Program (82)

App. II, p. 177

902-426-6135

Table 19 (cont'd.)

Indicator Research: Environmental Quality--Water

<u>Agency Contact</u>	<u>Research Project</u> (<u>Identification Number</u>)	<u>For Further Information</u>
L. Harding Manager, Marine and Estuarine Programs Environmental Protection Pacific and Yukon Region Environment Canada Kapilano 100--Park Royal West Vancouver, B.C. V7T 1A2	Contaminant Data Management/ Display (83)	App. II, p. 179
	Sediment Quality Triad (84)	App. II, p. 180

K.L.E. Kaiser Lakes Research Br. National Water Research Inst.	Nearshore/Offshore Interactions Project (85)	App. II, p. 224

D.C.L. Lam Rivers Research Br. National Water Research Inst.	Long Range Transport of Airborne Pollutants Project (86)	App. II, p. 226

Table 19 (cont'd.)

Indicator research: Environmental Quality--Water

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
R.J. Maguire Rivers Research Br. National Water Research Inst.	Contaminants/Pesticides Project (87)	App. II, p. 228
Blair McRae Environmental Projects Officer Pesticides Dir. Agriculture Canada SBI Building, 2nd Floor Ottawa, Ont. K1A 0C6 993-4544	identification and characterization of potentially leachable pesticides and areas in Canada vulnerable to groundwater contamination by pesticides (247) Water Residue Investigation Program (248)	App. II, p. 22 App. II, p. 23
A. Mudroch Lakes Research Br. National Water Research Inst.	Sediment/Water Interactions Project (88)	App. II, p. 230

Table 19 (cont'd.)

Indicator Research: Environmental Quality--Water

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
E.F. Muller Renewable Resources Extraction and Processing Div. Industrial Programs Br. Environment Canada Ottawa, Ontario K1A 0H3	National Sampling Program for Dioxins/Furans in Sediments and Fish (89)	App. II, p. 184
953-1138		
K. Novakowski Rivers Research Br. National Water Research Inst.	Groundwater Contamination Project (90)	App. II, p. 232
I. Sekerka Research and Applications Br. National Water Research Inst. P.O. Box 5050 Burlington, Ontario L7R 4A6	Analytical Chemistry Project (91)	App. II, p. 234
416-336-4601		

Table 19 (cont'd.)

Indicator Research: Environmental Quality--Water

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
W.M.J. Strachan Lakes Research Br. National Water Research Inst.	Air/Water Interactions Project (92)	App. II, p. 236

Table 20

Indicator Research: Environmental Quality--Food

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. H.B.S. Conacher Chief, Food Research Div. Health Protection Br. Health and Welfare Canada 3rd Floor East Sir Frederick Banting Bldg. Tunney's Pasture, Ottawa K1A 0L2 957-0944	Assessment of Effluents from Pulp/ Paper Mills (93) General monitoring of selected foods (94) National Human Breast Milk Survey (95) Total Diet Survey (96)	App. II, p. 428 App. II, p. 429 App. II, p. 430 App. II, p. 431
Dr. F. Iverson A/Chief, Toxicology Research Div. 2nd Floor East Sir Frederick Banting Bldg. Tunney's Pasture, Ottawa K1A 0L2 957-0987	Chronic Toxicity of Vomitoxin (deoxynivalenol), a mycotoxin found in cereal grains (97) Systemic Toxicity of Shellfish toxins (98) Teratogenic potential of chem- icals (99)	App. II, p. 434 App. II, p. 433 App. II, p. 435

Table 20 (cont'd.)

Indicator Research: Environmental Quality--Food

<u>Agency Contact</u>	<u>Research Project (Identification Number)*</u>	<u>For Further Information</u>
F. Iverson (cont'd.)	Toxicity of Polychlorinated Biphenyls to Primates (rhesus monkeys) (100)	App. II, p. 436

Table 21

Indicator Research: Environmental Quality--Human Health and Exposure

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
M.E. Meek Health Protection Br. Health and Welfare Canada Environmental Health Ctr. Tunney's Pasture Ottawa, Ontario K1A 0L2	Drinking Water (101)	App. II, p. 439
D. Meyerhof Health Protection Br. Health and Welfare Canada 954-6672	Environmental Radioactivity and Human Health Monitoring (102)	App. II, p. 441
R. Otson Health Protection Br. Health and Welfare Canada 957-1646	Indoor Air Quality and Energy (103)	App. II, p. 443

Table 21 (cont'd.)

Indicator Research: Environmental Quality--Human Health and Exposure

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
M. Raizenne Health Protection Br. Health and Welfare Canada 957-1877	Long-Range Transport of Air Pollutants (104)	App. II, p. 445

J. Sitwell Health Protection Br. Health and Welfare Canada 957-1501	Industrial and Commercial Chemicals (105)	App. II, p. 447

D.C. Villeneuve Health Protection Br. Health and Welfare Canada 957-1837	Environmental Pollutants (106)	App. II, p. 450

Table 21 (cont'd.)

Indicator Research: Environmental Quality--Human Health and Exposure

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
F. Wandelmaier Health Protection Br. Health and Welfare Canada 957-1854	Pesticides (107)	App. II, p. 452

Table 22

Indicator Research: Environmental Quality--Soil

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Peter Fehr Head, Soil Conservation Planning Section Prairie Farm Rehabilitation Administration 1901 Victoria Ave. Regina, Sask. S4P 0R5	Crop Residue Surveys (249)	App. II, p. 475
306-780-5071		
John L. Nowland A/Director Land Resource Research Ctr. Research Br. Agriculture Canada Room 1141, Neatby Bldg. Ottawa, Ont. K1A 0C6 995-5011, Ext. 7801	Evaluation of Some Selected Methodologies for Soil Quality Monitoring and Data Collection (244) Loss of Soil Quality by Erosion (245) Soil Quality Evaluation System for Assessing Agricultural Sustain- ability in Canada (246)	App. II, p. 14 App. II, p. 16 App. II, p. 17

Table 23

Indicator Research: Environmental Quality--Precipitation

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
S. McNair Atmospheric Environment Service Environment Canada 4905 Dufferin Street Downsview, Ontario M3H 5T4 416-739-4980	Canadian Air and Precipitation Monitoring Network (CAPMON) (71)	App. II, p. 39

Table 24

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
P. Boudreau Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-3246	Application of Acoustics to Habitat management (108)	App. II, p. 276
P.F. Brodie Bedford Institute 902-426-3246	Bioenergetics of Marine Mammals (109)	App. II, p. 277

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
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R. Dermott
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Department of Fisheries and
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867 Lakeshore Blvd.
P.O. Box 5050
Burlington, Ontario
L7R 4A6

Benthic Habitat Concerns, Bay of
Quinte and Eastern Lake Ontario
(110)

App. II, p. 365

416-336-4868

22

J.C. Davis
Regional Director, Science
Pacific Region
Institute of Ocean Sciences
Department of Fisheries
and Oceans
P.O. Box 6000
9860 West Saanich Rd.
Sidney, B.C.
V8L 4B2

Species Interactions (276)

App. II, p. 408

Biological Oceanography (281)

App. II, p. 413

604-356-6515

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J.A. Elliott Director, Physical and Chemical Sciences Dir. Bedford Institute 902-426-8478	Marine Chemistry Division: deter- mination of inorganic and organic chemical distributions in the marine environment (111)	App. II, p. 258
J.D. Fitzsimons Fish Habitat Studies Div. Bayfield Inst. 416-336-4862	Slimy Sculpin Tumor Monitoring (112)	App. II, p. 367
W.G. Franzin Department of Fisheries and Oceans Central and Arctic Region 501 University Crescent Winnipeg, Manitoba R3T 2N6 204-983-5082	Nanisivik and Polaris Mine Monitoring Program (113)	App. II, p. 392

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J.N. Gearing Maurice Lamontagne Inst. Department of Fisheries and Oceans P.O. Box 1000 Mont-Joli, Quebec C5H 3Z4 418-775-6590	Géochimie organique du Saint- Laurent--Variations spatio-tempor- elles enregistrées dans les sédiments (114)	App. II, p. 310
	Géochimie organique du Saint- Laurent--Variabilité de la matière organique en suspension (115)	App. II, p. 311
	Procédés biologique et chimique affectant les abondances naturelles du C-13 et N-15 (116)	App. II, p. 312
C. Gobeil Oceanographe geo-chimiste Maurice Lamontagne Inst. 418-775-6591	Accumulation et cycle du plomb dans les sédiments en milieu marin côtier (117)	App. II, p. 314
	Rôle de l'interface eau-sédiment dans le cycle du phosphore en milieu marin (118)	App. II, p. 315
	Distribution et diagénèse du mercure dans les sédiments du chenal Laurentien (119)	App. II, p. 316

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
C. Gobeil (cont'd.)	L'arsenic dans le fjord du Saguenay (120)	App. II, p. 317
D.C. Gordon Bedford Institute	Fish Habitat Assessment Advice (121)	App. II, p. 278
L. Harding Manager, Marine and Estuarine Programs Environmental Protection Pacific and Yukon Region Environment Canada Kapilano 100--Park Royal West Vancouver, B.C. V7T 1A2	Contaminant Data Management/ Display (83) Vancouver Harbour (123)	App. II, p. 179 App. II, p. 181

604-666-2917

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
G.C. Harding Bedford Institute 902-426-8478	Zooplankton Habitat Studies (124)	App. II, p. 279
B.T. Hargrave Bedford Institute 902-426-8478	Contaminant Fluxes in Marine Food Webs (125)	App. II, p. 280
	LRTAP Organic Studies (126)	App. II, p. 281
R. Hesslein Section Leader, Experimental Limnology Freshwater Inst. Department of Fisheries and Oceans 501 University Crescent Winnipeg, Manitoba R3T 2N6	Whole lake acidification studies and recovery from acid conditions (127)	App. II, p. 384
	Wetland acidification studies (128)	App. II, p. 385
	Whole lake cadmium study (129)	App. II, p. 386

204-983-5251

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
R. Hesslein (cont'd.)	Using stable isotopes of carbon, nitrogen and sulfur as indicators of food web structure and migration patterns of fish (130)	App. II, p. 387
	Food chain manipulation studies--top predator introduction (131)	App. II, p. 388
P.V. Hodson Ecotoxicology Div. Bayfield Inst. 416-336-4864	Biochemical Indicators of Chemical Effects on Fish (132)	App. II, p. 368
	Hamilton Harbour Rehabilitation--Contaminants Assessment (133)	App. II, p. 370
	Indicateurs de toxicité dans le poisson (with DFO Quebec Region) (134)	App. II, p. 319

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. O.E. Johansson Fish Habitat Studies Div. Bayfield Inst. 416-336-4708	Long Term Biological Program-- Lake Ontario (135)	App. II, p. 371

Dr. M.G. Johnson Fish Habitat Studies Div. Bayfield Inst. 519-371-0040	Zooplankton and Larval Whitefish in Lake Huron (136)	App. II, p. 373

P.D. Keizer Habitat Ecology Div. Bedford Institute 902-426-8478	Benthic/Pelagic Exchanges (137)	App. II, p. 282

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. J.R.M. Kelso Fish Habitat Studies Div. Bayfield Inst. 705-942-2848	LRTAP--Turkey Lakes Calibrated Watershed and Biomonitoring (138)	App. II, p. 374

S. Kerr Habitat Ecology Div. Bedford Institute 902-426-8478	Size-dependent and bioenergetic Processes in Fish Production Habitats (140)	App. II, p. 283

E.F. Muller Renewable Resources Extraction and Processing Div. Industrial Programs Br. Environment Canada Ottawa, Ontario K1A 0H3 953-1138	National Sampling Program for Dioxins/Furans in Sediments and Fish (89)	App. II, p. 184

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
M. Kingsley Chef, Division des mammifères marins et de la parasitologie Maurice Lamontagne Inst.	Contamination chez le marsouin commun (141)	App. II, p. 325
	Revue de la documentation sur les effets des PBC et des HAP sur le système immunitaire (142)	App. II, p. 326
418-775-6787	Arctic pinnipeds (36)	App. II, p. 324
G.L. Lacroix Aquaculture and Invertebrate Fisheries Div. Department of Fisheries and Oceans Biological Station St. Andrews, N.B. EOG 2XO	Impacts of Acid Rain on Salmonid Ecology (144)	App. II, p. 270
506-529-4517		

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project</u> (<u>Identification Number</u>)	<u>For Further Information</u>
M. Mercer Regional Director, Science Newfoundland Region Department of Fisheries and Oceans P.O. Box 5667 St. John's, Nfld. A1C 5X1 709-772-2027	Habitat Research and Assessment (145) Acid Precipitation Studies (146) Disease Research (147) Toxicology and Contaminants (148)	App. II, p. 252 App. II, p. 253 App. II, p. 254 App. II, p. 255
M. Munawar Ecotoxicology Div. Bayfield Inst. 416-336-4867	Rapid Toxicity Testing of Contam- inants Associated with Sediments and Effluents in the Great Lakes (149)	App. II, p. 377

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
H.B. Nicholls Head, Marine Assessment and Liaison Div. Bedford Institute 506-529-4517	Carbon Dioxide and Climate: Bio- geochemical Cycles in the Ocean (150)	App. II, p. 271

D.L. Peer Habitat Ecology Div. Bedford Institute 902-426-8478	Benthic Habitat Studies (151)	App. II, p. 284

R.H. Peterson Aquaculture and Inverte- brate Fisheries Div. Biological Station St. Andrews, N.B. 506-529-4517	Effects of Low pH on Salmonid Development (152)	App. II, p. 272

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Bill Ritchie Science Br., Gulf Region Department of Fisheries and Oceans P.O. Box 5030 Moncton, N.B. E1C 9B6 506-857-6230	Shellfish Phycotoxin Program (264) habitat evaluation techniques (267)	App. II, p. 297 App. II, p. 300
T.W. Rowell Habitat Ecology Div. Bedford Institute 506-529-4517	Inshore Molluscan Habitat Studies (153)	App. II, p. 285
G. Sharp Bedford Institute 506-529-4517	Marine Plant Assessment and Research (154)	App. II, p. 273

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J.E. Stewart Habitat Ecology Div. Bedford Institute 506-529-4517	Microbial Ecology (155) Molluscan Toxins I (156)	App. II, p. 286 App. II, p. 287

Dr. R. Stewart Freshwater Inst. 204-983-5023	Arctic Marine Mammal Ecology and Assessment Research (157)	App. II, p. 395

D.V. Subba Rao Habitat Ecology Div. Bedford Institute 506-529-4517	Molluscan Toxins II (158) Role of Picoplankton in the Marine Ecosystem (159)	App. II, p. 288 App. II, p. 289

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J.C. Therriault Maurice Lamontagne Inst. 418-775-6595	Relations trophiques et chemin- ement des contaminants dans la chaîne trophique de l'estuaire du Saint-Laurent (160)	App. II, p. 361

G.H. Tremblay Maurice Lamontagne Inst. 418-775-6593	Analyse des contaminants dans les sédiments (161)	App. II, p. 350

G. Walsh Chef interimaire Division de l'Habitat du poissons Maurice Lamontagne Inst. 418-775-6593	Effets sous-létaux des conditions environnementales dans le fleuve Saint-Laurent (162) Analyse des contaminants présents dans le poisson de l'Estuaire moyen du Saint-Laurent (163)	App. II, p. 352 App. II, p. 353

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
G. Walsh (cont'd.)	Etude à long terme de la réponse à l'acidification des communautés biologiques de 4 écosystèmes lacustres du bouclier canadien (164)	App. II, p. 354
	Toxicité des fluoro-complexes d'aluminium vis-à-vis du saumon atlantique (165)	App. II, p. 355
	Etude des effets sous-létaux de l'acidification printanière sur le saumon atlantique (166)	App. II, p. 356
	Etude à long terme de la réponse des communautés benthiques des rivières à saumon de la Côte-Nord face à l'acidification (167)	App. II, p. 357
	Evaluation de habitats des rivières à saumon de la Côte-Nord vulnérables à l'acidification (168)	App. II, p. 358
	Paléo-écologie de l'acidification récente de lacs de l'est du Canada (169)	App. II, p. 359

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
W.D. Watt Biologist Department of Fisheries and Oceans P.O. Box 550 Halifax, Nova Scotia B3J 2S7	Biomonitoring long range transport of air pollutants (170)	App. II, p. 291
902-426-3606		
D.M. Whittle Ecotoxicology Div. Bayfield Inst.	Great Lakes Contaminants Surveillance (171)	App. II, 378
416-336-4565		
D.J. Wildish Department of Fisheries and Oceans Biological Station St. Andrews, N.B.	Aquaculture Ecology Research (172)	App. II, p. 274
506-529-4517		

Table 24 (cont'd.)

Indicator Research: Environmental Quality--Fish Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
P.T.S. Wong Ecotoxicology Div. Bayfield Inst. 416-336-4559	Biochemical Indicator in Aquatic Ecosystems: Adenine Nucleotides (139)	App. II, p. 376

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954-7676

Impacts of Acidification on Littoral
Microcrustacea (175)

App. II, p. 464

Table 25

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. Glen D. Adams Research Scientist Canadian Wildlife Service 115 Perimeter Road Saskatoon, Sask. S7N 0X4	Waterfowl Recruitment on Converted Rangelands in the Transition Forest (257)	App. II, p. 138
306-975-4093		
E.D. Balkwill A/Head, Zoarcheological Identification Ctr. National Museum of Natural Sciences 990-6410	Duck Stomach Contents (173) Caspian Tern Pellet Analysis (174)	App. II, p. 460 App. II, p. 461

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
B. Braune Toxic Substances Evaluation and Monitoring Div. National Wildlife Research Ctr. Canadian Wildlife Service Environment Canada Ottawa, Ontario K1A 0H3	National Survey of Contaminants in Waterfowl (176)	App. II, p. 50
J.F. Carreiro Chief, Wildlife Conservation and Environmental Quality Ontario Region Canadian Wildlife Service 1725 Woodward Dr. Ottawa, Ontario K1A 0H3	Annual monitoring of contaminant levels and bioeffects in fish-eating birds on the Great Lakes: I. Contaminant Levels in Herring Gull Eggs (177)	App. II, p. 105
952-0931	Annual monitoring of contaminant levels and bioeffects in fish-eating birds on the Great Lakes: II. Congenital Anomalies in Embryonic and Post-hatch Double-crested Cormorants (178)	App. II, p. 106

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J.F. Carreiro (cont'd.)	Annual monitoring of contaminant levels and bioeffects in fish-eating birds on the Great Lakes: III. Breeding Biology of Herring Gulls and Foster's Terns on Walpole Island (179)	App. II, p. 107
	Lower Great Lakes Basin Wetlands at Risk (180)	App. II, p. 108
	Wildlife and Agricultural Pesticides in Southern Ontario: I. Bird usage of Agricultural Fields (181)	App. II, p. 103
	Wildlife and Agricultural Pesticides in Southern Ontario: II. Breeding Biology Parameters of Swallows, Bluebirds, and Kestrels nesting near Apple Orchards along the Niagara Escarpment (182)	App. II, p. 104
	Wildlife support for Remedial Action Plans for Great Lakes Areas of Concern (183)	App. II, p. 109

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J. Desgranges Research Scientist Quebec Region Canadian Wildlife Service 1141 route de l'Eglise P.O. Box 10100 Ste-Foy, Quebec G1V 4H5 418-648-6126	Use of Fledging Osprey Feathers to Monitor Mercury Contamination in the James Bay Hydroelectric Reservoirs (184) Contaminant Bio-monitoring Program for the St. Lawrence River Fauna (185)	App. II, p. 98 App. II, p. 99
Lynne Dickson Biologist Canadian Wildlife Service Western and Northern Region 2nd Floor, 4999-98 Ave. Edmonton, Alberta T6B 2X3 403-468-8924	Monitoring Study: Impact of Oil Development on Birds in the Beau- fort Sea Region (186)	App. II, p. 116

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
J. Elliott Toxic Substances Evaluation and Monitoring Div. National Wildlife Research Ctr. 997-6075	Contaminants Monitoring, Development and Coordination (187) Survey of Contaminants (PCDDs, PCDFs, OCS, Hg) in Snapping Turtle Eggs from Lake Ontario and the St. Lawrence River (188)	App. II, p. 51 App. II, p. 52
	Organochlorine Levels and Effects in Eggs of Accipiter Hawks (189)	App. II, p. 53
	Monitoring Organochlorine in Plasma of Migratory Raptors (190)	App. II, p. 54
	Toxicological Studies of PCB Isomers in Japanese Quail and American Kestrels: Porphyria and Enzyme Induction (191)	App. II, p. 55
G.A. Fox Toxic Substances Evaluation and Monitoring Div. National Wildlife Research Ctr. 997-6076	Studies on the prevalence, nature and causes of developmental abnormalities and reduced hatching success of avian embryos (192)	App. II, p. 56

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Fox (cont'd.)	Great Lakes Bioeffects Data Review/ write-up (193)	App. II, p. 57
	Is the diet and embrionic milieu of Great Lakes herring gulls and cormorants in the Great Lakes and great blue herons in B.C. deficient in iodine and vitamin A? (194)	App. II, p. 58
	Detection of early embryonic death and infertility in eggs (195)	App. II, p. 59

App. II, p. 140

Lead Shot Study (258)

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204-983-5247

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
S. Kennedy Toxicology Research Div. National Wildlife Research Ctr. 997-6077	Avian liver Cell Culture Studies of the Mixed Function Oxidase and Porphyria Inducing Potencies of Polyhalogenated Aromatic Hydro carbons (196)	App. II, p. 60
	Biochemical approaches to the differential diagnosis of bird exposure to organophosphates and Carbamates (197)	App. II, p. 62
T. Lash Chief, Endangered Species and Transboundary Wildlife Canadian Wildlife Service Ottawa, Ontario	Endangered Species/Biological Diversity (198)	App. II, p. 47

953-4389

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
K. Lloyd Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr.	Pesticide registration reviews of new active ingredients and research permits in support of Pest Control products Act (199)	App. II, p. 63
997-6131	Special reviews of pesticide impacts on wildlife for registered pesti- cides identified as a priority by CWS (200)	App. II, p. 64
W.K. Marshall Chief, Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr.	Priority and new substance hazard evaluations (201)	App. II, p. 65
997-3044		

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
P. Mineau Toxic Substances Evaluation and Monitoring Div. National Wildlife Research Ctr.	Evaluation of the utility of the avian reproduction studies currently provided as part of pesticide registration (202)	App. II, p. 66
997-3045	The Sublethal Effects of an Organophosphate Insecticide on Learning and Memory in Birds (203)	App. II, p. 67
R. Norstrom Chief, Chemistry Research Div. National Wildlife Research Ctr.	Contaminant Dynamics and Trends in Great Lakes Herring Gulls (204)	App. II, p. 73
997-1411	Dioxins in wildlife (205)	App. II, p. 75
	Qualitative GC-MS Identification of Contaminants in Wildlife (206)	App. II, p. 77
	Toxic PCBs in the environment (207)	App. II, p. 78
	Long Range Transport and Accumulation of Organochlorine Contaminants in Arctic Marine Ecosystems (208)	App. II, p. 80

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
D.B. Peakall Chief, Toxicology Research Div. National Wildlife Research Ctr. 997-2780	Biochemical methods to assess exposure of birds to toxicants (209) Effects of Toxic Chemicals in the Great Lakes Ecosystem (210) Studies of pollutant effects on DNA (211)	App. II, p. 69 App. II, p. 70 App. II, p. 71
Dr. M. Poulin Chief, Botany Div. National Museum of Natural Sciences 990-6454	Plantes vasculaire du Canada (212) Lichens du Canada (213) Diatomées marines et dulcicoles du Canada (214)	App. II, p. 466 App. II, p. 467 App. II, p. 468

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
R. Pratt Chief, Migratory Birds Conservation Canadian Wildlife Service Ontario Region 952-0932	Effects of Acidic Precipitation on Waterfowl Populations of Northern Ontario (215)	App. II, p. 114
W.H. Prescott A/Chief, Migratory Bird Management Atlantic Region Canadian Wildlife Service Environment Canada P.O. Box 1590 Sackville, N.B. EOA 3CO 506-536-3025	Populations, Bioenergetics and Feeding Ecology of the Common Eider in Southwestern New Brunswick (216) Research on Breeding and Feeding Ecology of Colonial Seabirds (217) Pelagic Ecology of Seabirds in Atlantic Waters (218) Forest Bird Research (219)	App. II, p. 90 App. II, p. 91 App. II, p. 92 App. II, p. 93

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
W.H. Prescott (cont'd.)	Toxic Chemicals--General and Pesticides Impact of Toxic Chem- icals and Pesticides on Migratory Birds (220)	App. II, p. 94
	Lead Shot Effects (221)	App. II, p. 95
	The Effects of Acid Precipitation on Watersheds and Wetland Habitats in Nova Scotia (222)	App. II, p. 96
P. Thompson Ecotoxicologist Canadian Wildlife Service Quebec Region	Impact of Dioxin/Furan Exposure from a BKM Effluent on Fish- eating Birds of the St.-Maurice River (223)	App. II, p. 101

418-648-5016

Table 25 (cont'd.)

Indicator Research: Environmental Quality--Wildlife Populations

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
S. Wetmore Chief, Migratory Birds Pacific and Yukon Region Canadian Wildlife Service P.O. Box 340 Delta, B.C. V4K 3Y3 604-946-8546	Dioxins in Great Blue Herons, Cormorants and Diving Ducks in the Strait of Georgia, B.C. (224) Monitoring the impact of agri- cultural pesticides on birds (225) Monitoring organochlorine and heavy metals in hunted waterfowl in the Pacific and Yukon Region (226) Survey of ingested lead shot in hunted waterfowl in B.C. and Yukon (227)	App. II, p. 120 App. II, p. 121 App. II, p. 122 App. II, p. 123
West Coast Seabird Monitoring Program (228)		App. II, p. 124

Table 26

Indicator Research: Environmental Quality--Forests

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Brian Haddon FORSTATS Coordinator Forestry Canada 20th Floor Place Vincent Massey Ottawa, Ontario K1A 1G5	FORSTATS Program: Forest Management Statistics (19)	App. II, p. 416
	FORSTATS Program: Forest Resource Dynamics Data (28)	App. II, p. 418
Joe J. Lowe Manager, Forest Inventory Project Petawawa National Forestry Institute Forestry Canada Box 2000 Chalk River, Ontario K0J 1J0	FORSTATS Program: Forest Inventory Project (231)	App. II, p. 421
613-589-2880		

Table 26 (cont'd.)

Indicator Research: Environmental Quality--Forests

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. B.H. Moody FIDS Coordinator Science Directorate Forestry Canada 21st Floor Place Vincent Massey Ottawa, Ontario K1A 1G5	Forest Insect and Disease Survey Coordination (232)	App. II, p. 424

997-1107

Table 27

Indicator Research: Environmental Quality--Landscape

<u>Agency Contact</u>	<u>Research Project (Identification Number)</u>	<u>For Further Information</u>
Dr. Glen D. Adams Research Scientist Canadian Wildlife Service 115 Perimeter Road Saskatoon, Sask. S7N 0X4 306-975-4093	Prairie Pothole Project--Redvers Habitat Evaluation (256)	App. II, p. 137
G. Lee Chief, Habitat and Land Use Canadian Wildlife Service Environment Canada Ottawa, Ontario K1A 0H3 953-1434	Wildlife Habitat Conservation Strategy (26)	App. II, p. 44

4. CONCLUSIONS

There is an abundance of federal environmental indicator research activity. Table 28 provides a summary description of the current research in relation to the indicator framework developed for this study. The potentially most useful projects are listed along with the major apparent gaps. It is important to keep in mind that these are apparent gaps because there may well be some additional relevant work which was not identified in the survey. It should also be noted that a considerable amount of additional indicator research is likely to be carried out by provincial agencies and universities.

The large volume of federal indicator work offers considerable opportunity for expanding and improving the scientific base for the SOE program. The primary goals for Environment Canada's SOE Program should be to 1) make the best use of the existing work, and 2) initiate or stimulate such additional work as is needed to ensure a comprehensive reporting system based on a selected set of indicators.

There are some significant obstacles to meeting these goals:

1. The scope of the problem is very broad. The range of research activities which is encompassed by SOE

Table 28

Federal Environmental Indicator Research--Summary Evaluation

Indicator Category	Major Projects	Comments
<u>Human Activities</u> <u>Waste Generation</u> - mining and smelting - manufacturing - municipal - energy - transportation	#1-3 #2-4, 9, 10 #2, 3, 9 #2, 3, 236 #2, 3	Project #2, National Inventory of CO², and #3, Inventory of Common Pollutants, can provide general measures of waste production by mining and smelting, manufacturing, municipalities, energy industries, and transportation. More specific measures should be available for these sectors, but relatively few projects were identified in the survey. The Industrial Programs Branch of Environment Canada is the key agency working in this area, but the branch's response to the questionnaire was incomplete.
<u>Harvesting</u> - fisheries - agriculture	#30, 37-46, 49-50, 277, 280 #18	Catch statistics for fisheries are used by Fisheries and Oceans Canada in stock assessments (see environmental assets--fisheries) The Statistics Canada Census of Agriculture provides comprehensive statistics on agricultural production.

Table 28 (cont'd.)

Federal Environmental Indicator Research--Summary Evaluation

Indicator Category	Major Projects	Comments
<u>Human Activities</u> <u>Harvesting (cont'd.)</u> - forestry	#19	Forestry Canada's FORSTATS Program compiles forest harvesting statistics for each of the provinces and territories.
- hunting and trapping	#20	The Canadian Wildlife Service can provide some information related to hunting of migratory birds, but the provinces are the primary sources of hunting and trapping statistics.
<u>Depletion of Non-renewable Resources</u>	#21	The National Energy Board publishes the biannual Canadian Energy Supply and Demand report, analysing supplies and rates of depletion for gas and oil.
<u>Environmental Assets/Quantity</u> - water resources	#22, 24, 25	The Inland Waters Directorate of Environment Canada compiles national statistics on water supply and use.

Table 28 (cont'd.)

Federal Environmental Indicator Research--Summary Evaluation

Indicator Category	Major Projects	Comments
<u>Environmental Assets/ Quantity (cont'd.)</u> - land resources	#27	The Applications Research Div., Sustainable Development and SOE Branch, DOE maintains national data bases on ecosystem capability and response to stresses and on ecosystem quality and use.
- forests	#28	Forestry Canada's FORSTATS Program compiles information on the factors which increase or decrease the extent and value of forest resources.
- fisheries	#30, 32, 33 36, 37, 39- 46, 49-51 266, 277- 280	Fisheries and Oceans Canada maintains data on hundreds of fish stocks in regional data bases. Marine species of commercial interest are emphasized, with less information available for freshwater fish (where jurisdiction is shared with the provinces) and little data for non-commercial species.
- wildlife	#56, 64, 65 238-243	The Canadian Wildlife Service compiles population statistics for a number of species, with primary emphasis on migratory birds. Agriculture Canada's Biosystematics Research Ctr. conducts research on a large number of wild plants and insects.

Table 28 (cont'd.)

Federal Environmental Indicator Research--Summary Evaluation

Indicator Category	Major Projects	Comments
<u>Environmental Assets/ Quantity (cont'd.)</u> - non-renewable resources	#68-70	Energy, Mines and Resources Canada carries out inventories and resource assessments for a range of minerals and fossil fuels. Presumably, this includes uranium statistics. However, the Uranium and Nuclear Energy Branch did not respond to the survey.
<u>Environmental Quality</u> - air	#2, 71-75 273	The Atmospheric Environment Service and the Environmental Protection Directorate are the key agencies for air quality monitoring and analysis of pollution trends. Together, they can provide a national profile of air quality.
- water (freshwater and marine)	#76-92, 274 275	The Inland Waters Directorate compiles statistics and conducts a variety of water quality research studies which could provide useful information for SOE reporting related to freshwaters. Fisheries and Oceans Canada and DOE's Environmental Protection Directorate conduct some related research for the marine environment.

Table 28 (cont'd.)

Federal Environmental Indicator Research--Summary Evaluation

Indicator Category	Major Projects	Comments
<u>Environmental Quality</u> (cont'd.)		
- food	#94-96, 99	Health and Welfare Canada's Health Protection Branch does comprehensive research on contaminants in food.
- human health and exposure	#101-107	The Health Protection Branch does a broad range of research on human exposure to toxic substances.
- soil	#244-246 249	Research in this area is limited, although Agriculture Canada has proposed a comprehensive program of soil quality analysis which could be of considerable value for SOE reporting.
- precipitation	#71	The CAPMoN Program of the Atmospheric Environment Service uses sulfur and nitrogen as indicators of spatial and temporal variations and long-term trends in the chemical composition of air and precipitation, and wet and dry deposition in all regions of Canada.

Table 28 (cont'd.)

Federal Environmental Indicator Research--Summary Evaluation

Indicator Category	Major Projects	Comments
<u>Environmental Quality</u> (cont'd.) - fish populations	#89, 111, 114 115, 123, 125- 128, 132, 135 138, 139, 144 146, 150, 152 164, 166, 169- 171, 175, 281	Fisheries and Oceans Canada conducts numerous regional and local studies, particularly in the areas of acid rain and toxic chemicals in fish.
- wildlife populations	#176, 180-182 198, 205, 208 215, 222	The Canadian Wildlife Service maintains a comprehensive data base, the National Survey of Contaminants in Waterfowl (project #176), as well as conducting a number of supporting regional studies. The CWS also carries out a variety of regional habitat studies and acid rain research.
- forests	#19, 28, 231 232	Forestry Canada's FORSTATS Program (projects 19, 28 and 231) and the Forest Insect and Disease Survey (#232) provide national level indicator data for commercial forests.

Table 28 (cont'd.)

Federal Environmental Indicator Research--Summary Evaluation

Indicator Category	Major Projects	Comments
<u>Environmental Quality</u> (cont'd.) - landscape	#26	Federal work on indicators of landscape quality appears to be quite limited. The only significant project is the Wildlife Habitat Conservation Strategy of the CWS.

reporting means that a large volume of information and a large number of people will be involved in developing and applying indicators--coordination and consistency will be major problems.

2. The environmental indicator concept as presently defined by the Sustainable Development and SOE Branch is very general: it includes a wide variety of measures of environmental quality, resource stocks and human activities. This is a departure from the traditional, narrower view of environmental indicators as discrete measures of air or water quality (components of environmental monitoring programs).

Many of those contacted for the survey at first expressed surprise that they were considered to be indicator researchers. When the indicator concept as defined by the branch was then described, a common reaction was: "Everything we do is environmental indicator work". Because of the broad scope and general definition, it is difficult to specify precisely the information needed from the federal research community.

3. SOE reporting does not at present direct any basic indicator research in Canada. Thus there is no established science or set of procedures for development and application of SOE indicators. This

has two significant implications: 1) all existing federal research was designed for other purposes, and lends itself to SOE reporting only by accident; and 2) even for that research which is directly applicable, SOE reporting is viewed by the workers involved as an "add-on" which will take time and energy away from their "regular" activities. Many of those surveyed showed a reluctance to volunteer to be involved in an indicator research network.

4. There is a considerable amount of specialized research under way with results which could be suitable for SOE reporting, but each of these projects can only give a small part of the total picture. The challenge is to pull it all together in the most effective way.

There are several important steps which can be taken to Make the best use of existing indicator research.

1. The Sustainable Development and SOE Branch must make it as easy as possible for scientists to participate and contribute their knowledge. The branch should clearly define what is needed from researchers. What are the specific information needs for the five-year SOE reports and other reports? For other publication formats? Which indicator data are needed by

decision-makers? What data processing systems are required?

2. It will be important to make the network effective. A strong SOE indicator program will depend on establishing good working relationships with those most actively involved in indicator work.
3. Scientists should be encouraged to provide advice on the best ways to use their research results for SOE reporting. Their input will be essential to determine the most appropriate reporting methods and formats.
4. Researchers need incentives to participate. The Sustainable Development and SOE Branch should provide opportunities for scientists to publish their work. This might involve a series of special DOE publications or providing assistance for researchers to publish elsewhere.

Initiating or stimulating such additional work as is needed to ensure a consistent reporting system based on a selected set of indicators is a longer term goal. The best approach to achieving it will depend on the results of efforts to make more effective use of the existing indicator work. Any expansion from the current research is certain to involve the managers and researchers contacted for this

survey. If the Sustainable Development and SOE Branch can strengthen ties with these individuals--establishing an effective indicator research network--it will have an excellent foundation for new initiatives.

The Action Plan which follows presents a five-year strategy for developing a comprehensive SOE indicator research and reporting program.

5. ACTION PLAN

Gelinas and Slaats (1989) state that "the purpose of SOE indicators is to synthesize, out of a mass of inventory data, information on the state of the Canadian environment in a manner which is readily understandable by informed non-scientists including the public". This description of purpose suggests a set of objectives which must be met to develop a comprehensive federal SOE indicator program:

1. Develop a model or organizational framework for SOE reporting to serve as a broad basis for deriving indicators.
2. Determine the scope of environmental inventory data maintained by the federal government.
3. Identify general categories of indicators which may be developed from the inventory data.
4. Analyse the inventory data to identify specific, quantitative indicators which can be reported in an SOE context.
5. Determine the specific reporting methods and formats appropriate for each type of SOE indicator.

The first objective has been met through the stress-response framework which guides the Canadian SOE program and which was used to develop the indicator research framework described in this report. Objectives 2 and 3 have been addressed in the preceding sections of the report and the appendices.

This plan describes a set of actions and presents a schedule for meeting objectives 4 and 5.

5.1 Objective 4: Identifying Specific Indicators which can be Reported in an SOE Context

The projects identified in this report can yield hundreds of individual environmental indicators. The first step is for Sustainable Development and SOE Branch staff to read the project descriptions to become familiar with the kinds of indicator projects which are underway. Table 28 on page 116 provides summary information on some of the major projects, but there are many others which may prove useful. Figure 1 is a step-by-step guide for using this report to identify projects in a particular subject area.

The next step, and potentially the most fruitful avenue of expanded effort, will be to contact the managers and researchers who responded to the survey. These are the

Figure 1

How to Identify and Locate Indicator Research Projects in a Given Subject Area

To obtain information on projects in any particular subject area, the reader should proceed in sequence from Table 1. (the indicator research framework), to the appropriate table in Chapter 3 (the summary listing of indicator projects), and then to Appendix II, (results of the survey of researchers). Note: all tables are shown in the List of Tables at the front of the report.

This is best illustrated with an example. If the reader were searching for projects related to pesticide contamination of wildlife, the procedure would be:

1. Find the appropriate subject area in Table 1 on page 5.

The subject area is "environmental quality--fish and wildlife populations" (under the "examples" column, the table tells us that this subject area includes toxic substance analysis in fish or wildlife).

2. Locate the project summary table which corresponds to the identified category from the framework.

The List of Tables directs the reader to Table 25 "Indicator Research: Environmental Quality--Wildlife Populations", on page 99.

3. Examine the list of projects in Table 25.

Pesticide/wildlife projects include: #176, National Survey of Contaminants in Waterfowl; #181, Wildlife and Agricultural Pesticides in Southern Ontario; #189 Organochlorine Levels and Effects in Eggs of Accipiter Hawks; and #197, Bird exposure to organophosphates and carbamates. The table provides a contact name for each project and directs the reader to the appropriate page in Appendix II for further information.

4. Refer to Appendix II for a description of the project objectives and the geographic area covered.

individuals directly responsible for the federal data bases and research programs which will form the basis of an expanded SOE Program. It will be necessary not only to obtain more detailed project information and research results, but to establish ongoing working relationships with the managers and researchers. The first contact could simply be a letter from a Sustainable Development and SOE Branch representative thanking the individual for responding to the survey, outlining future indicator work the branch has planned, and inviting requests for further information about SOE activities.

Establishing an indicator research network will require a strong effort to identify potential benefits for each agency to be involved. Researchers will be reluctant to add new tasks to already heavy work schedules. However, the good response rate obtained in the survey for this study demonstrates that many researchers are willing to share the results of their indicator work. Furthermore, there are several agencies and individuals who have demonstrated a particular interest in SOE reporting or are currently involved with SOE or similar activities.

Those currently involved in SOE reporting include:

- the chapter coordinators for the 1991 SOE Report (see Appendix VI);

- others involved with the 1991 report (the author's experience in editing the Fisheries and Oceans chapters of that report indicates that many people within a number of agencies have been involved in preparing the report);
- the Environment and Natural Resources Section of Statistics Canada (see Appendix VI);
- the SOE Reporting Section at Environment Canada's Centre Saint-Laurent in Montreal (Appendix VI);

Those involved in work closely related to SOE include:

- The Environmental Health Directorate of Health and Welfare Canada--the directorate expects to publish a major report on human health and the environment in 1991.
- Forestry Canada--the FORSTATS Program can provide a variety of useful information for SOE reporting, and Bill C-29, An Act to Establish the Department of Forestry, will require the Minister of Forestry to report annually to Parliament on "the condition of the forest resources of Canada".

Survey respondents (see Appendices I and IV) who showed a particular interest in SOE reporting include:

- R. Trottier, Biosystematics Research Ctr.,
Agriculture Canada;
- C. Hyslop, Canadian Wildlife Service;
- J. Whiting, Canadian Wildlife Service;
- S. Cumbaa, National Museum of Natural Sciences; and
- J. Heimbecker, Census of Agriculture, Statistics
Canada.

Establishing the indicator research network should initially concentrate on those agencies and individuals listed above, along with such others listed in this report which may be of particular interest. The Sustainable Development and SOE Branch should prepare a priority list of individuals to be involved in the indicator network. Branch representatives should then meet with each of these, to explore opportunities for cooperation in expanded indicator work. This would begin with one-on-one meetings to describe in detail the branch's plans for the SOE Program and to determine the level of interest among other agencies.

At this stage, the beginnings of an indicator research network will have been established. Following the initial round of meetings, the Sustainable Development and SOE Branch can prepare written profiles of the indicator research agencies. These profiles should document the agencies' current activities and future initiatives, and assess the potential for cooperative ventures.

A preliminary task of the network will be to develop a consistent set of accepted standards and procedures for SOE indicators. These can be used to evaluate and apply existing indicator research and to guide future research. Gelinas and Slaats (1989) provide a background for developing the standards and procedures.

5.2 Objective 5: Determining Reporting Methods and Formats Appropriate for Each Type of SOE Indicator

The indicator research network is primarily a means of access to the scientific expertise required for SOE reporting. Members of the network may be scientists themselves, managers of scientific programs, or other federal employees. Their primary role will be to obtain indicator data tailored to SOE needs.

The network should be expanded as necessary to meet specific information objectives which are determined by particular SOE subject areas. The broad scope of SOE reporting, and the numerous federal agencies and projects which could become involved, mean that these objectives will evolve, and the network should evolve with them. Note that those surveyed were asked to provide the names of other suggested contacts for indicator research (see the completed survey forms in Appendix II). These names should prove useful in expanding the network.

An effective network must address the needs of each of its members. Thus it will be important to focus on particular tasks facing the various federal indicator research agencies. The five-year SOE reports are an example of such tasks, as are the human health and the environment project of Health and Welfare Canada and the proposed state of the forest reports by Forestry Canada. These tasks could be facilitated by workshops or seminars involving network members with outside experts brought in as necessary. The workshops would focus on specific projects, but the results should apply to broader SOE issues.

Preparing the 1991 SOE Report is one task which currently occupies many federal agencies and researchers. Thus a potential workshop topic would be the lessons learned in producing the 1991 report, and the implications for future

reports. Such a session could be held in late 1991. This schedule would allow the Sustainable Development and SOE Branch to review this study and establish initial network contacts in advance of the workshop.

After developing consistent standards and procedures for SOE indicators, the network must involve individual scientists in selection of specific methods and formats for reporting indicator information. This would be done in small-group working sessions. The scientists' participation could be arranged through formal consulting arrangements or secondments involving specialists from various agencies. The specialists would initially provide instructions for presenting and interpreting results of existing research. In the future, however, the Sustainable Development and SOE Branch may wish to contract other agencies to provide scientific or technical support for new indicator projects.

Contracting new SOE indicator research will be expensive. Thus it will be important to explore other incentives for increased involvement of scientists. One type of incentive would be a series of special SOE publications featuring the work of individual researchers. The details of this publication series should be developed in consultation with the research community.

5.3 Schedule

The strategy proposed here would cover the five-year period from 1990/91 to 1994/95, based on the following schedule:

Year 1

1. Review the frameworks report.
2. Write to those on the contact list, acknowledging their response to the survey and inviting requests for further information about SOE reporting.
3. Prepare a priority list of major initial contacts for the indicator research network.
4. Meet with the selected initial contacts.
5. Prepare profiles of key federal agencies detailing, their environmental indicator research activities and proposed roles in an expanded SOE Program.

Year 2

1. The network develops federal standards and procedures for SOE indicators.

2. Hold a workshop on lessons learned in preparing the 1991 SOE Report.

Year 3

1. Hold working sessions with federal research scientists to develop detailed SOE reporting methods and formats based on existing indicator research.
2. Develop consulting agreements with scientists as necessary for reporting existing indicator work.
3. Hold a workshop on a task involving network members (human health and the environment is a potential topic).
4. Develop a special publication series in consultation with indicator researchers.

Years 4 and 5

1. Produce special publications on selected SOE indicators.

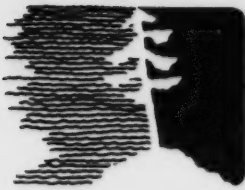
2. Contract scientists for new research projects as required to expand the federal indicator research framework.
3. Hold workshops on additional tasks involving network members (reporting on the state of the forest is one possible topic).

REFERENCES

Gelinas, R. and J. Slaats (1989) Selecting Indicators for State of the Environment Reporting (Draft). Report No. 8, Strategies and Scientific Methods, SOE Branch, Environment Canada, Ottawa.

Kuhnke, D.H. (1989) Silviculture Statistics for Canada: An 11-Year Summary. Information Report NOR-X-301, Forestry Canada, Edmonton.

Statistics Canada (1986) Human Activity and the Environment: A Statistical Compendium. Catalogue 11-509E, Statistics Canada, Ottawa.



Planning /
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October 4, 1989

Dr. L. Buffa
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Dear Sir:

Environment Canada has recently established a national state of the environment (SOE) reporting program which aims to provide Canadians with a better understanding of environmental conditions and trends. As well as describing these conditions and trends, SOE reporting is intended to increase awareness of relationships between human activities and environmental conditions. The ultimate goal is to provide consumers and decision-makers with the knowledge to respond to environmental problems.

An important step toward improving the SOE reporting process is to identify those key measures (indicators) which are most representative of the state of the environment and the condition of our natural resource base. The desired set of environmental indicators would collectively provide a comprehensive profile of environmental quality and natural resource assets. To achieve this goal, Environment Canada's State of the Environment Reporting Branch has contracted me to help in attempting to establish a network of federal researchers who are developing, applying or share an interest in environmental indicators. The scope of indicator work to be covered is quite broad. It includes nine distinct categories of research workers. These researchers use data to indicate trends in:

1. the production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;

4. the quantity and distribution of renewable resource stocks;
5. the size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

To begin the task of developing the environmental indicator research network, the SOE Branch would like to identify those people in your department who are involved in research, development and application of indicators.

No doubt your schedule allows only limited time for responding to an inquiry such as this one. Therefore, I have limited my information request to three main items:

- a description of the purpose of your research program as it relates to environmental indicators;
- a brief profile of your major research projects; and
- your suggestions for further contacts among federal environmental indicator researchers

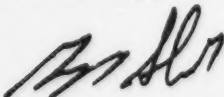
I have enclosed a questionnaire form which may help you in responding. In preparing the questionnaire, I have assumed that the first page might be filled out by managers responsible for particular areas of research, and that the attached "indicator research project description sheets" might be filled out by individual researchers.

I would appreciate it if you can respond by October 20. This will allow me to incorporate your input for the SOE indicator research plan which I am drafting for Environment Canada.

If you have any questions or wish to respond by phone, I may be reached at 613-837-6110.

Thank you very much.

Sincerely,



Gregg Sheehy

Enclosures

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name:

Telephone:

Title:

Address:

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Project objective(s)

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH NETWORK

INDIVIDUALS WHO RECEIVED THE QUESTIONNAIRE

AGRICULTURE

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953-1120

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Mr. D.J. Hay
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953-1141

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604-666-0064

Ms. Gisele Jacob
A/Director
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Canada Centre for Inland Waters
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416-336-4599/4740

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514-283-5869

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403-468-8041

G. Mezzetta, Director
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Environment Canada
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G1V 4H5

418-283-0178

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Industrial Programs Branch
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K1A 0H3

997-1390

Mr. E. Norrena
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Environment Canada
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902-426-3593

H. Samant
Chief, Laboratory Division
Bedford Institute of Oceanography
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902-426-6237

Mr. K. Shikaze, Director
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25 St. Clair Ave. E., 7th Floor
Toronto, Ontario
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416-973-1055

Inland Waters Directorate

Mr. Tim Marta
Program Analysis and
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Inland Waters Directorate
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997-3820

Sustainable Development

Mr. G.D. Lee
Chief, Habitat Conservation
Sustainable Development Branch
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953-1434

Mr. Ed Wiken
Chief, Ecological Applications
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997-1090

ENERGY, MINES AND RESOURCES

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Director, Resource Evaluation
Petroleum Resources Branch
Energy Mines and Resources Canada
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992-1194

Mr. W. J. McCann
Director General
Mineral and Metals Commodities Branch
Energy Mines and Resources Canada
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Ottawa, Ontario
K1A OE7

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K1A OE7

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Mr. W. Nassichuk
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Physical and Chemical Sciences Directorate
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Fisheries and Oceans Canada
Bedford Institute of Oceanography
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Mr. M. Mercer
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A1C 5X1

709-772-5045

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Biological Sciences Directorate
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200 Kent Street
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K1A 0E6

990-0271

FORESTRY

Mr. B. Haddon
FORSTATS
Forestry Canada
Place Vincent Massey
Ottawa, Ontario
K1A 1G5

997-1107

Mr. Joe Lowe
Forestry Systems and Statistics
Petawawa National Forestry Institute
Forestry Canada
Chalk River, Ontario
K0J 1J0

613-589-2880

Ms. Denyse Rousseau
Director, Protection
Forestry Canada
Place Vincent Massey
Ottawa, Ontario
K1A 1G5

997-1107

HEALTH AND WELFARE

Mr. J.R. Elliott
Director General
Field Operations Directorate
Health and Welfare Canada
Health Protection Bldg.
Tunney's Pasture
Ottawa, Ontario
K1A 0L2

957-1794

Dr. S.W. Gunner
Director General
Food Directorate
Health and Welfare Canada
Health Protection Bldg.
Tunney's Pasture
Ottawa, Ontario
K1A OL2

957-1821

Dr. S. Winthrop
Senior Advisor
Environmental Health Directorate
Health and Welfare Canada
Room 134
Environmental Health Centre
Tunney's Pasture
Ottawa, Ontario
K1A OL2

957-3143

NATIONAL ENERGY BOARD

Mr. W.A. Hiles
Director
Energy Supply Branch
National Energy Board
473 Albert Street
Ottawa, Ontario
K1A OE5

998-7952

NATIONAL MUSEUM OF NATURAL SCIENCES

Dr. S.L. Cumbaa
Assistant Director
Collections and Research
National Museum of Natural Sciences
P.O. Box 3443, Stn. "D"
Ottawa, Ontario
K1P 6P4

996-9281

NATIONAL RESEARCH COUNCIL

Dr. I.C.P. Smith
Director
Biological Sciences
National Research Council
Ottawa, Ontario
K1A 0R6

990-0884

STATISTICS CANADA

Mr. G. Beelen
Manager
Census of Agriculture
Statistics Canada
R.H. Coats Bldg.
Tunney's Pasture
Ottawa, Ontario
K1A 0T6

951-8712

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This appendix presents detailed responses from a Fall, 1989 survey of federal managers and researchers involved in environmental indicator work. See Appendix I for a sample survey questionnaire and covering letter.

AGRICULTURE CANADA

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK
SURVEY QUESTIONS

Your Name: Robert Trottier

Telephone: 613-996-1665

Title: Director, Biosystematics Research Centre

Address: Agriculture Canada, Ottawa, K1A 0C6

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).
-

See letter, following page

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.
-

3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-



Agriculture
Canada

Research Direction générale
Branch de la recherche

OTTAWA, Ontario
K1A 0C6

Votre référence Your file

Notre référence Our file

Biosystematics Research Centre

November 15, 1989

MEMORANDUM TO: Laurie Benzing-Purdie
Research Coordinator, Environment

Re: Indicator Research Network

Please find below BRC's response to your questionnaire on Federal Environmental Indicator Research National Survey:

The Biosystematics Research Centre, Agriculture Canada (BRC) has 44 scientists who conduct research on the classification and systematics of the fungi, plants, insects, spiders, mites and nematodes of Canada. Although the BRC is primarily concerned with systematic studies of concern to Agriculture Canada, we are the only major research organization in the country with the expertise and collections data base to conduct broad spectrum studies using both plants and arthropods as indicators of environmental changes.

To assist our research studies, we maintain the Canadian National Collection of Insects (over 15 million specimens) and fungi, the National Culture Collection of Fungi, the Plant Gene Resource Repository (seeds, clones), and the Department of Agriculture Herbarium. All of these collections are the largest of their type in Canada. These collections serve as a National data base, essential to any long term study on the use of plants and insects as biological indicators of climatic change by pollution, global warming, or other factors. Specimens in these collections are used as vouchers for distributional studies, seasonal variations, bases for descriptive analysis of the flora and fauna of Canada, etc.

Canada

The BRC is also developing a National Biological Data Base which will eventually include information on all the insects, arachnids, plants and fungi of Canada. This data base will contain all the essential taxonomic information, distributional data, host data and, for selected species, résumés of the economic importance and biology of each species. The data base is designed to be flexible and additional fields can be added as required. Again environmental research using plants and insects as indicators would find this data base an invaluable resource.

The BRC also maintains two large specialized libraries, the Entomology Library and the Plant Library which are specialized libraries for systematic studies.

The BRC is divided into 6 projects, Plant Gene Resource, Economic Plants, Economic Fungi, Soil and Water Organisms, Beneficial Insects and Insect Pests. I have summarized their activities pertinent to your questions.

Plant Gene Resource activities are concerned with preserving the genetic diversity of crop plants and wild relatives of crop plants (especially if native and endangered). The PGRC is interested in plant species that indicate levels of contamination capable of threatening agricultural sustainability.

Research activities in the Economic Plant Project relevant to bio-indicators are the assembly of data on indigenous plants of Canada and foreign plants of economic significance. Distribution of plants is well known at the local level and therefore plants have the potential of being very useful as indicators of environment change.

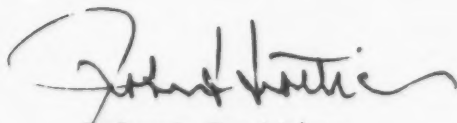
The three entomology projects each conduct research activities relevant to studies of environmental change. Many species of soil and water organisms are extremely sensitive to pollutants, acidic levels, or temperature changes. Research is currently underway to determine which insects and mites would be most useful as bio-indicators and to establish techniques where these arthropods would be used to assess changes in soil and water faunas.

Much of the research of the Economic Fungi Project is relevant to the study of environmental change. Specific projects are concerned with air contamination, toxin production, production of renewable resources such as mushrooms used for human consumption, effect of fungi on recycling of nutrients from rotting wood and utilization of mycorrhizal fungi as indicators of soil fertility and contamination of soil by fungicides.

Conclusion

The Biosystematics Research Centre is a large research organization whose facilities (research staff, collections, biological data base, library) are essential for broad spectrum studies of effects of environmental change on plants and arthropods on using plants and arthropods to assess environmental change and predict effects of these changes.

Other government departments or other research establishments are strongly encouraged to use these resources and to develop collaborative research programs with scientists at the BRC. Further enquiries are welcomed and should be addressed to the Director, Biosystematics Research Centre.



Robert Trottier
Director

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Plant Gene Resource

Project objective(s): Plant Gene Resource Activities are concerned with preserving the genetic diversity of crop plants and wild relatives of crop plants (especially if native and endangered). The PGRC is interested in plant species that indicate levels of contamination capable of threatening agricultural sustainability.

Geographic scope (circle one): global
national
regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Economic Plants

Project objective(s): Research activities in the Economic Plant
Project relevant to bio-indicators are the assembly of data on indigenous plants of Canada and foreign plants of economic significance. Distribution of plants is well known at the local level, and therefore plants have the potential of being very useful as indicators of environmental change.

Geographic scope (circle one): global

national

regional

local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Economic Fungi

Project objective(s): Assembly of data on Canadian fungi.

Geographic scope (circle one): global
national
regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Soil and Water Organisms

Project objective(s): Objectives include conducting research relevant to studies of environmental change.

Geographic scope (circle one): global
 national
 regional
 local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Beneficial Insects

Project objective(s): Objectives include conducting research relevant to studies of environmental change.

Geographic scope (circle one): global
national
regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Insect Pests

Project objective(s): Objectives include conducting research relevant to studies of environmental change.

Geographic scope (circle one): global
national
regional
local

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: John L. Nowland

Telephone: 995-5011 Ext. 7801

Title: A/Director, Land Resource Research Centre, Research Br., Agr. Canada

Address: Room 1141, K.W. Neatby Bldg., Ottawa, Ontario K1A 0C6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Please see attached.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

See above.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Don Oliver (via Dr. R. Trottier), Biosystematics Research Centre

Dr. N. Tape, Director, Food Research Centre - for contaminants in food.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- (2.) rates of harvest and renewal of renewable natural resources;
- (3.) rates of extraction of non-renewable natural resources;
- (4.) quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- (6.) levels of contaminants in air, water or (land);
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Evaluation of Some Selected Methodologies for
Soil Quality Monitoring and Data Collection

Project objective(s) To evaluate the capability of selected field
measurement procedures for monitoring changes in soil quality with time.

Geographic scope (circle one) global
national
(regional)
local

If regional or local, what is the geographic area covered?

Agricultural soil zones in Quebec and Atlantic provinces.

Methods for Soil Quality Monitoring and Data Collection

The quality of Canadian farmland is perceived to be declining steadily as a consequence of many conventional agricultural practices. The processes causing decline of soil quality (degradation processes) have been grouped into five major categories: soil erosion (wind and water), compaction, salinization, acidification and loss of organic matter. These processes are not all going on at any one location, nor at the same rates.

The research will be directed at determining and evaluating selected field monitoring procedures which can be used to determine rates of soil degradation under different land management types.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- (2.) rates of harvest and renewal of renewable natural resources;
- (3.) rates of extraction of non-renewable natural resources;
- (4.) quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- (6.) levels of contaminants in air, water or (land);
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Loss of Soil Quality by Erosion

Project objective(s)

To develop improved methods of estimating soil erosion; determine residual changes in chemical and physical quality of soils following erosion; identify soil conservation needs.

Geographic scope (circle one)

global
national
 regional
 local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- (2.) rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- (4.) quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Soil Quality Evaluation System for Assessing
Agricultural Sustainability in Canada

Project objective(s): See last paragraph on page 1.

Geographic scope (circle one): global
(national)
regional
local

If regional or local, what is the geographic area covered?

THE DEVELOPMENT OF A SOIL QUALITY EVALUATION SYSTEM
FOR ASSESSING AGRICULTURAL SUSTAINABILITY IN CANADA
- A RESEARCH PROPOSAL

i

EXECUTIVE SUMMARY

Soil quality changes with time in response to environmental and land use influences. These changes have positive and negative impacts on soil productivity. They also may have impact on the quality of air and water resources.

While considerable research and associated effort has gone into understanding the relationship between land management and maintenance of soil quality, there is not complete agreement on the impact of this on the kind, direction and rate of change in soil quality and, in turn, the impact of this change in soil quality on soil productivity. Predictive systems utilizing improved models of the key processes affecting soil quality provide a major opportunity to more critically assess the impact of agricultural policy and programs, and the effects of land management practices, on the sustainability of agricultural production in Canada and to provide a data base for the five-year State of the Environment Report so that policy makers, agencies responsible for soil management and conservation, producers and the public will have current information on the quality and sustainability of Canada's agricultural land base.

The proposed program will provide nationally accepted standards for evaluating soil quality, and a periodic assessment of the status of soil quality and degradation. It will identify and explain the processes that result in changes to soil quality and develop procedures and systems for predicting these changes. It will also provide a means of measuring changes to soil quality over time, so that the effectiveness of improvements in land management can be monitored. Finally, it will develop the capability to evaluate the impact in change to soil quality on soil productivity and the sustainability of agricultural production systems.

See next page for last para

Approximately 22 PY/YR of LRRC resources are required for this program in the initial three years, reducing to one-half this level thereafter. Fiscal resource requirements from the LRRC are estimated at \$1.5 M for the first three years, dropping to between \$0.5 M and \$1.0 M in succeeding years. Extensive collaboration is required between scientists within the LRRC as well as with scientists from various agencies and institutions across Canada and the United States.



Agriculture
Canada

Food Production and
Inspection Branch

Direction générale
Production et inspection des aliments

Pesticides Directorate
Ottawa, Ontario
K1A 0C6
TEL: (613) 993-4544
FAX: (613) 998-1312

Your file Votre référence

Our file Notre référence

November 21, 1989

3355-5-3

MEMORANDUM TO: Laure Benzing-Purdie
 Research Coordinator
 Research Branch

RE: SOE Reporting Indicator Research Network

Please find attached our contribution to this project. Would you please indicate to Gregg Sheehy that while we do not undertake research per se we are certainly a user group in both the development of registration guidelines for pesticides and the development of regulatory positions for pesticides.

Blair N. McRae
Environmental Projects Officer
Issues, Planning and Priorities Division

Attachment

BNM/jed
03731

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Blair McRae

Telephone: (613) 993-4544

Title: Environmental Projects Officer

Address: Pesticides Directorate
Agriculture Canada
SBI Building, 2nd Floor
Ottawa, Ontario K1A 0C6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Agriculture Canada under the authority of the Pest Control Products Act is
responsible for ensuring the safety merit and value of pesticides sold and
used in Canada. The first project targets areas for further research and
monitoring. Data from these studies will support the development of
appropriate regulatory positions dealing with pesticides in groundwater.
The second program is informational and educational and is intended to
prevent contamination where possible through the understanding of how it
occurs.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Identification and characterization of potentially leachable pesticides and areas in Canada vulnerable to groundwater contamination by pesticides.

Project objective(s) To identify suspect pesticides and vulnerable areas so that research investigation monitoring programmes can be targetted.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Water Residue Investigation Program

Project objective(s)

Safe and judicious pesticide use. Our aim is to promote grower safety, avoid direct contamination of water, and to gather information on areas or pesticides of concern in terms of leaching potential.

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

ENERGY, MINES AND RESOURCES CANADA

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: R. Conn

Telephone: 992-1194

Title: Manager, Petroleum Resources

Address: Economic & Financial Analysis
Energy, Mines & Resources Canada
580 Booth St., Ottawa, Ontario
K1A 0E4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Provide analysis and advice on potential energy resource supplies
by analysing and advising on the resource assessment activity of the
Geological Survey of Canada

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

R.M. Proctor GSC/ISPG

Brian Bowers NEB

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
- (5.) size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Western Basin Natural Gas Study

Project objective(s)

To determine the economic constraints of the resource endowment.

Geographic scope (circle one)

global

national

(regional)

local

If regional or local, what is the geographic area covered?

Western Canada

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
- (5) size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Mackenzie Delta/Beaufort Sea Economic Analysis

Project objective(s)

To determine the economic constraints of the resource endowment.

Geographic scope (circle one)

global
national
(regional)
local

If regional or local, what is the geographic area covered?

Mackenzie Delta and adjacent Beaufort Sea - Canada only.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. Lloyd R. Snowdon Telephone: 403 - 284-0110
Title: Head, Geochemistry Subdivision 403 - 292-7035 (After Nov. 15/89)
Address: Geological Survey of Canada
3303 - 33rd St., N.W.
Calgary, Alberta T2L 2A7

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

EMR has established special budgets for Environmental Geochemistry and Global Change resegrch. Within these guidelines we have established projects dealing with trace elements in fossil fuels and petroleum spill detection and characterization.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ☒ 1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Environmental Geochemistry

Project objective(s)

1. Catalog quantitative trace element concentrations in coal and petroleum. 2. Determine element mobility controls in natural and industrial settings. 3. Detect and fingerprint spilled petroleum and petroleum products.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: J. David Hughes

Telephone: (403) 284-0110

Title: Coal Geologist

Address: Geological Survey of Canada
3303 - 33rd St., N.W.
Calgary, Alta. T2L 2A7

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

~~See objectives (previous page) - results of Inventory studies are made available through publications in a variety of scientific journals. Digital primary information and completed computer models are made available to private and public sector agencies. Computer models are available for immediate response to queries from outside parties.~~

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
- ☒ 3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
- ☒ 5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

National Coal Inventory for Canada

Project objective(s)

To compile primary geological, trace element/contaminant, petrographic and environmental data from coal deposits across Canada in a computer-processable form. To utilize these data to develop computer models capable of providing predictive insights into the geological processes underlying coal-seam geometry and trace element/contaminant distribution to provide the capability to quantify Canada's coal resources according to extraction technologies, trace element/contaminant distributions, alternative uses of the overlying land surface, and a variety of other parameters.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Neil McIlveen Telephone: 995-5602

Title: Director, Energy & Fiscal Analysis

Address: 17th Floor
580 Booth Street
Ottawa, Ontario
K1A 0E4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

. Develop projections of greenhouse gas emissions from energy
use as a basis for policy analysis and formulation.
Model results will be used to test implications of policy
alternatives.
Results will form part of EMR's contribution to DOE's position
paper, Federal-Provincial Energy Ministers Task Force,
Intergovernmental Panel on Climate Change (IPCC)

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Mr William Jarvis, Director General,
Efficiency and Alternative Energy Branch, EMR
995-0081

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- (1) production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- (6) levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Greenhouse Gas Emissions from Energy Use
in Canada

Project objective(s)

. projection of CO₂, Methane, VOCs etc from
energy in Canada by sector and region to 2020.
- projections developed from EMR's energy demand model
- projections provide basis for assessment of:
- emission volumes under different scenarios
- policy options

Geographic scope (circle one)

global
(national)
regional
local

If regional or local, what is the geographic area covered?

ENVIRONMENT CANADA:
ATMOSPHERIC ENVIRONMENT SERVICE



Environment
Canada

Environnement
Canada

Atmospheric
Environment
Service

Service
de l'environnement
atmosphérique

4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Your file Votre référence

Our file Notre référence

October 31, 1989

Mr. G. Sheehy
Environmental Consultant
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

In response to your letter of September 29th, the work of the Secretariat for the Changing Atmosphere is mainly concerned with the coordination of scientific input into the planning, development, implementation and evaluation of response strategies to atmospheric pollution concerns such as acid rain, climate change and stratospheric ozone depletion. The work of federal/provincial scientists involved in these changing atmosphere issues ranges from the determination of emission sources and measurements of pollution concentrations in air and precipitation, to the understanding and modelling of their transport and transformation in the air and ultimate environmental and socio-economic effects.

Our scientists thus have been involved with the development and monitoring of key measures (indicators) in the air, aquatic, soil, vegetation and wildlife environments for some time, especially as they relate to acid rain, since this has been an environmental concern for more than a decade in Canada. Much of that work has been undertaken under the guidance of federal/provincial working groups.

To monitor compliance with, and effectiveness on the environment of Canadian air quality control programs, including acid rain regulations and the recently signed NOx Protocol, I suggest the following indicators:

Emission limits: * 2.3 million tonnes (50% of 1980 base level) of SO₂/year in eastern Canada
* 1987 levels of NO_x/year by 1994

Deposition loads: * 20 Kg wet SO₄/year

Atmospheric concentrations: * Rural: Precipitation
pH, SO₄, NO₃-N, Cl,
Ca, Mg, Na, K, NH₄-N
Air Concentrations
Particulate: SO₄, NO₃,
Cl, Na, NH₄, K
Gaseous: HNO₃, SO₂

Canada

For further detail see Attachment 1--CAPMoN DESCRIPTION

- * Urban--Please see Attachment 2--Technical Annex, Table 1.2, for recommended ozone, NO₂, NH₃, and SO₂ objectives

In addition, I suggest the following indicators for monitoring impacts on the aquatic and terrestrial environments which relate to acid rain:

- Aquatic systems:
- * Alkalinity
 - * Hydrogen
 - * DOC/DIC
 - * SO₄, Organic S, Total S
 - * NO₃, NH₄, Organic N, Total N
 - * Major ions: Al, Fe, Ca, Mg, Na, K, Cl
 - * Silica
 - * Trace metals: Hg, Cd, Pb, Zn, Cu
 - * Trace organics: OrgChl, PCB, ChlBen

- Forests:
- * Casting of green or uncharacteristically shaped needles
 - * Premature discolouration and shedding of needles
 - * Unexplained dieback
 - * Early flattening of tree crowns ("storks nesting")
 - * Abrupt decline in foliage of annual ring growth

For further detail see Attachment 3--Forest Insect and Disease Conditions in Canada 1985

- Soils:
- * Base saturation
 - * Cation exchange capacity
 - * SO₄, Organic S, Total S
 - * NO₃, NH₄, Organic N, Total N
 - * Metals: Ca, Mg, Na, K, Fe, Al
 - * Carbon
 - * Hydrogen
 - * Trace metals: Hg, Cd, Pb, Zn, Cu
 - * Trace Organics: OrgChl, PCB, ChlBen
 - * Pb210, C14, Pollen

- Vegetation:
- * Species abundance
 - * Decomposition
 - * Growth Vigour
 - * Plant Chemistry: S, N, C, Ca, Mg, Na, K, Al, Fe

To assist you in the establishment of a list of Canadian researchers who are applying or share an interest in environmental indicators, I am listing recommended contacts and their area of interest and phone numbers:

FEDERAL CONTACTS:

- S. Watson, Emissions and Controls, (819) 953-1114
- D. Jeffries, Aquatic Effects, (416) 336-4969
- K. Percy, Terrestrial Effects, (506) 452-3524

L. Carlson, Terrestrial Effects, (416) 739-4051
C. Franklin, Health Effects, (613) 957-1848
J.J. Hechler, Material Effects, (514) 641-2280
S. McNair, Canadian Air and Precipitation Monitoring Network (CAPMoN), (416)
739-4980
T. Dann, National Air Pollution Surveillance (NAPS) contact, (613) 998-4705

I hope that the above information will meet your needs. Should you require further elaboration of the information provided please do not hesitate to contact me.

Sincerely yours,

for *W. Hart*
T.G. Brydges
Acting Senior Advisor
Secretariat for the
Changing Atmosphere
(416) 739-4643

Attachments

cc: Federal Contacts

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: MALCOLM E. STILL Telephone: (416) 739-4866
 Title: HEAD, AIR QUALITY SERVICES LIAISON OFFICE
 Address: 4905 DUFFERIN STREET
DOWNSVIEW ONTARIO M3H 5T4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The mission of the Air Quality Services Program of the Atmospheric Environment Service is to provide government with adequate information on the chemical and physical state of the atmospheric environment for informed policy decisions relating to environmental quality.

The Air Quality and Inter-Environmental Research Branch is involved in the collection/publication of the following indicators: sulphur and nitrogen deposition, carbon dioxide, tropospheric ozone and atmospheric haze.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Mr. J. A. Williams
Chief, Pollution Measurement Division
(613) 998-4130

- regarding NAPS network

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

*Canadian Air and Precipitation
Monitoring Network (CAAPMN)*

Project objective(s)

*To measure regional-scale spatial and temporal
variations and long-term trends in the chemical
composition of air and precipitation, and wet and
dry deposition, in all regions of Canada.
The specific indicators are sulphur and nitrogen levels.*

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Carbon Dioxide

Monitoring

Project objective(s)

To collect weekly carbon dioxide samples from Little Island, Cape M. Francis and West. To analyze these samples and to publish carbon dioxide concentrations

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Stratospheric Ozone Monitoring

Project objective(s)

To publish data on stratospheric ozone, total ozone observations, UV-B levels, effect, vertical distribution of ozone from Lambert observations, and vertical distribution of ozone from ozone sondes observations.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Stratospheric Ozone Monitoring

Project objective(s)

To present the new level of stratospheric ozone through the bi-annual meeting of the AEC's Advisory Committee on Stratospheric Ozone

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

ENVIRONMENT CANADA:
CANADIAN WILDLIFE SERVICE

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Gerry Lee

Telephone: 819-953-1434

Title: Chief, Habitat and Land Use

Address: Canadian Wildlife Service, Environment Canada, 10th Floor,
PVM, 351 ,St. Joseph Blvd., Hull, P.Q. K1A 0H3

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).
-

Re Category #4 (quantity and distribution of resource stocks) Under the Wildlife Habitat Conservation Strategy currently being developed for CWS, research on habitat quantity, quality and changes in same will be initiated* to facilitate priority setting for acquisition programs (including those of the NAWMP); MOUs with other federal agencies; identification and managing of sensitive areas for emergency measures response; impacts on wildlife habitat from global warming, toxic substances and land use change; and special requirements for endangered species.

*Due to reassignment of staff to SOE and other initiatives, work on these areas to date has been limited to the strategy itself, plus some habitat targetting work. Balance of effort has been on federal land work.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Colleen Hyslop

Telephone: 819-953-1419

Title: Coordinator, Nongame Birds & Latin American Program

Address: CWS, Ottawa, Ont. K1A 0H3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Database on Nongame Migratory Bird Populations. This proposed database will serve 2 functions: to indicate the status and trends of migratory bird species in Canada (especially nongame species) and to indicate the health of the environment with respect to specific impacts such as acid rain, marine pollution, forestry practices.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 - ② rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Database on Nongame Migratory Bird Populations

Project objective(s): To compile and evaluate available information on migratory bird population status and trends.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK
SURVEY QUESTIONS

Your Name: Tim Lash Telephone: 819-953-4389
Title: Chief, Endangered Species and Transboundary Wildlife
Address: Canadian Wildlife Service, 17th Floor, Place Vincent Massey,
Environment Canada, Ottawa, K1A 0H3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).
-

Endangered Species/Biological Diversity Project:

To provide mapping, on a national scale, of COSEWIC-listed threatened and endangered species by "ecoregions", related to total mammalian and avian species by ecoregions; this provides indicators of broad-scale relative stress on the genetic diversity in Canada by ecoregion.

Annual update of COSEWIC data is planned. Project will contribute to federal roles in national endangered species recovery, to public education about biological diversity in Canada, and to environmental assessment overviews.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.
-

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 - ② rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Endangered Species/Biological diversity Project

Project objective(s): (as on first page)

Technical objective is to make the data available and usable on SPANS geographic information system to enable analysis against many other variables, and flexible formatting for presentations.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

CANADIAN WILDLIFE SERVICE
WILDLIFE TOXICOLOGY AND SURVEYS BRANCH

PROJECT SHEETS
1989-1990

HEADQUARTERS

SECTION VI: TOXIC CHEMICALS:

KEITH MARSHALL
PIERRE MINEAU
RICHARD TURLE
KAREN LLOYD
ALAIN BARIL
GLEN FOX

997-3044
997-3045
997-1412
997-6073
997-6131
997-6076

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: CE/7Project Title: National Survey of Contaminants in Waterfowl.Project Leader: B. Braune Tel.: 953-5959Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
B. Braune (HQ)	MNR	Started in 1988
K. Marshall (HQ)	Great Lakes Institute	Ongoing
R. Turle (HQ)	DIAND	
J. Jensen (HQ)	Health and Welfare Canada	
Regional Waterfowl Biologists		

Objectives:

Work Plan Goal No.: 3304.2

1. To provide a comprehensive data base on contaminants in waterfowl to Health and Welfare Canada so that the risk to human health of eating those waterfowl may be assessed, and so that consumption guidelines may be established, if necessary.
2. To provide information to consumers on the levels of toxic chemical residues in waterfowl, and to make recommendations for further research to complement the information presently available.

Scientific Rationale and Program Relevance:

Safety of waterfowl and other wild (country) foods for consumption is a major concern of native peoples and hunters. Environment Canada (CWS) is expected to have information on levels of contaminants in migratory game birds and other edible wildlife of federal interest. A review of toxic chemical residues in Canadian game birds reveals that there are very few recent data. Elevated levels of some chemical compounds have, however, been found in waterfowl from certain areas (i.e., Lake St. Clair, St. Lawrence River).

Up until recently, it has been CWS policy not to survey systematically the levels of contaminants in migratory game birds in a program analogous to MOE's Contaminants in Sport Fish Program. A national survey of contaminants in waterfowl has now been formulated, however, and was initiated last year (Fall 1988).

Budget Estimate:

	<u>Person Years</u>	<u>O&M (\$'000)</u>
- A-base Toxics (101)	0.4	15.0K

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CE-2~~Project Title: Contaminants Monitoring, Development and Coordination.Project Leader: J. ElliottRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
Section Head (Vacant) Evaluator (Vacant) G. Fox		Ongoing

Objectives:

To initiate and coordinate contaminant monitoring and surveillance activities for CWS. This involves, in particular, the design of national monitoring programs and taking the lead in the interpretation and publication of resulting data and reviews.

Scientific Rationale and Program Relevance:

CWS has a mandate to ensure adequate protection of migratory birds and other federal wildlife from hazards of toxic substances and to provide information on, and assessment of, the presence, trends and ecological effects of toxic substances in the environment in order to support the Canadian Environmental Protection Act. This is achieved by designing and conducting appropriate monitoring/survey studies of priority contaminant levels and effects.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project NO.: ~~CE-3~~

Project Title: Survey of contaminants (PCDDs, PCDFs, OCs, Hg) in Snapping Turtle eggs from Lake Ontario and St. Lawrence River.

Project Leader: J. Elliott

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
J. Elliott R. Norstrom	MNR National Museum Contractors	2-3 years 88 -biological survey 89-90 collection

Objectives:

Using Snapping Turtles as indicators, determine the spatial pattern of organic contaminants in local areas of contamination from the Niagara River to downstream Montreal.

Scientific Rationale and Program Relevance:

Snapping turtles have been shown to be useful indicators of organic contaminants in local wetland areas (Struger et al., in prep.). They have been shown to accumulate high levels of dioxins and furans as well as PCBs.

There are numerous industrial and agricultural sources of contaminants around Lake Ontario and the St. Lawrence River. We propose to locate specific sources, especially for dioxins, furans, and PCBs and then to have contractors determine the feasibility of collecting snapping turtle eggs from animals resident in impacted areas. Based on information from this survey, we will plan to collect eggs in 1988 and possibly again in 1989. Eggs would be analyzed at NWRC for OCs, PCBs, dioxins and furans and for Hg by contract.

Reference: Struger, J., J.E. Elliott, M. Obbard, D.V. Weseloh. In prep Organochlorines in Great Lakes Snapping Turtles.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: CE-4Project Title: Organochlorine levels and effects in eggs of Accipiter Hawks.Project Leader: J. ElliottRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
J. Elliott	B. Wood R. McMurtry (collectors)	1986 - collections started 1989 - collections complete

Objectives:

To determine levels and effects of organochlorines in eggs of Sharp-shinned, Cooper's Hawks and Goshawks.

Scientific Rationale and Program Relevance:

This project evolved from the initial stages of our raptor review. There is a lack of historical data on Sharp-shinned Hawks in particular. Sharp-shinned Hawks feed on mainly insectivorous birds, which tend to accumulate high OC levels. Populations from central Canada winter in the southern U.S. and down into Central America, sites of continued organochlorine usage. OC levels in 3 eggs from New Brunswick and livers of road-kills from B.C. indicate that this species is still exposed to high OC levels, as theorized. Cooper's Hawks are also migrants to Latin America; however, they include more granivorous species of birds and also some reptiles and mammals in their diet. Goshawks tend to be boreal forest residents, which feed mainly on resident species, especially grouse, doves and small mammals. Therefore, there is also an opportunity for an interesting comparative study of food chain accumulation of contaminants in a terrestrial ecosystems.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: CE-5Project Title: Monitoring organochlorine in plasma of migratory raptors.Project Leader: J. ElliottRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
J. Elliott	B. Duncan (Hawk Cliff) Whitefish Point Bird Observatory Michigan	- 3-year pilot study - 1985 began - 1988-89 completion of preliminary study - 1989-90 wrap up and publish

Objectives:

1. Assess breeding versus wintering OC exposure in selected species (Sharp-shinned Hawks, Merlins) using plasma samples.
2. Assess the value of Sharp-shinned Hawk as a means of monitoring migratory bird exposure to OCs in Latin America.
3. Survey current OC levels in plasma from a selection of banded raptors (Merlins, Red-tailed Hawks, Northern Harriers).

Scientific Rationale and Program Relevance:

Ongoing OC use in Latin America and U.S., plus continuing persistence of many compounds in cool temperate ecosystems, requires some continued monitoring of avian populations for organochlorine contamination. Analysis of blood plasma samples has potential as an efficient non-intrusive means of sampling large numbers of birds. Birds are obtained through cooperation of existing banding operations around the Great Lakes. A variety of species of different age classes and sexes can be obtained. Sharp-shinned Hawks feed mainly on small Passerines. They follow the songbird populations during their migrations north and south and should therefore be integrating residues from exposure of their prey both on wintering and breeding grounds.

989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CE-6~~Project Title: Toxicological studies of PCB isomers in Japanese Quail and American kestrels: Porphyria and enzyme induction.Project Leader: J. ElliottRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
J. Elliott	D. Peakall CWS B. Philogène (Ottawa U.) S. Kennedy CWS D. Jeffrey (Contractor)	3 year study. Began preliminary work in 1986/87. To be completed in 1988/89.

Objectives:

1. To examine the porphyrinogenic effects of selected PCB isomers in two species of birds.
2. To examine induction of drug metabolizing enzymes by PCBs.
3. To investigate the relationship between onset and severity of porphyria and induction of MFO's.

Scientific Rationale and Program Relevance:

PCBs are a continuing environmental hazard. Very little is known about the toxicology of individual PCB isomers in birds. Most available toxicological information, especially for birds, is based on dosing with commercial mixtures of PCBs, (Aroclors) which have little relevance to food chain exposure of weathered and metabolized mixtures. Since 1984, all the individual PCB congeners have become commercially available for toxicological studies. My study proposes to examine PCB congeners which are representative of broad classes of PCBs based on their biochemical effects on rats and other laboratory animals. Based on that work, PCBs can be classified according to their capacity to induce varying responses in the Mixed Function Oxidase Systems of hepatic detoxifying enzymes.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CE-8~~

Project Title: Studies on the prevalence, nature and causes of developmental abnormalities and reduced hatching success of avian embryos.

Project Leader: G.A. FoxRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
G.A. Fox D.V. Weseloh B. Collins	T. Kubiak (USFWS) J. Ludwig (consultant)	Started 1982 Ongoing.

Objectives:

To maintain and utilize the registry of congenital anomalies in the Great Lakes, and to assess its utility in detecting developmental toxins in Great Lakes food chains.

Scientific Rationale and Program Relevance:

Other than acute lethality, the most frequent impacts of contaminants observed in wild birds are those related to reproduction (i.e., eggshell thinning, reduced embryonic viability, and teratogenesis). There have been several "epidemics" of reduced hatchability and congenital abnormalities in Great Lakes fish-eating birds since 1970 but, to date, we have not been able to definitively identify the offending chemicals.

In 1988-89 two draft manuscripts were prepared for publication J. Great Lakes Res.; a general introductory paper, and another on "bill defects in young cormorants in the Great Lakes: I-historical background and occurrence 1979-1987".

.../2

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:

Project No.: ~~CE-9~~

Project Title: Great Lakes Bioeffects Data Review/write-up.

Project Leader: G.A. Fox

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
Glen Fox	D.V. Weseloh	Ongoing

Objectives:

Contribute to development of CWS strategy for monitoring and assessing sublethal bioeffects of contaminants in wildlife by:

1. Summarizing, evaluating and publishing the results obtained in the Great Lakes bioeffects research conducted prior to November 1984 by G.A. Fox and cooperators by:
 - a) preparing for publication, the draft manuscript prepared in 1983-89, entitled "Bill Defects in Young Cormorants in the Great Lakes. I. Historical Perspective and Occurrence 1979-1987".
 - b) preparing for publication, the manuscript entitled "Spatial and Temporal Variation in Hepatic Enlargement, Retinol Depletion, and Polyhalogenated Aromatic Hydrocarbon Residue Content in Great Lakes Herring Gulls".
 - c) preparing for publication, the draft manuscript on "Thyroid Function in Great Lakes Herring Gulls".
 - (d) preparing a manuscript on the spatial and temporal variation in the prevalence of supranormal clutches in Great Lakes Herring Gulls and the implications.
 - (e) preparing a manuscript on blood chemistry of Great Lakes gulls and the effects of food stress.
 - (f) preparing a manuscript on the gonadal cycle of the herring gull, based on data collected for this purpose in 1977 at various stages of the nesting cycle on Kent Island, New Brunswick.
2. Assisting in the development and preparation of CWS strategy for bioeffects monitoring by staying abreast of recent developments in the biochemical assessment of toxicant-induced impacts through monitoring the literature and attendance at relevant conferences and workshops on this subject.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CE~~ 10

Project Title: Is the diet and embryonic milieu of Great Lakes Herring Gulls and Cormorants in the Great Lakes and Great Blue Herons in B.C. deficient in Iodine and Vitamin A?

Project Leader: G.A. Fox

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
Glen Fox Chip Weseloh Jill Jensen Sean Kennedy Phil Whitehead	T. Kubiak (USFWS) J. Ludwig (consultant) G. Belward (USC)	1 year

Objectives:

To determine and report on:

1. The Iodine, Vitamin A and organochlorine content of the diet (regurgitations) of Herring Gulls and Cormorants from colonies under study for monitoring and bioeffects research.
2. The Iodine and Vitamin A content of fresh eggs of Herring Gulls and Cormorants from colonies under study for monitoring and bioeffects research.
3. The Vitamin A content of the yolk sacs of the 30 GB Heron chicks hatched during the 1988 laboratory study.

Scientific Rationale and Program Relevance:

1. Although we have shown that the Herring Gull is a sensitive indicator of local contamination as well as a lake-wide indicator, we have not made a serious attempt to correlate egg residue data with the diet of the gulls in that particular colony. The use of a pool of regurgitations will allow us to assess the level of contamination in the diet, and hopefully to better understand the role of winter movements vs local contamination in determination of body burden.
2. Great Lakes Herring Gulls suffer from goiter and thyroid dysfunction, and in some cases, marked Vitamin A depletion. The proposed work would help determine whether a) this is the result of dietary deficiency in Iodine and Vitamin A, and b) whether eggs from colonies where there is a history of poor embryonic survival and birth defects have low Iodine and Vitamin A levels. Both the thyroid and Vitamin A play important role in embryonic development.

.../2

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CE-11~~Project Title: Detection of early embryonic death and infertility in eggs.Project Leader: G.A. FoxRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
Glen Fox D.V. Weseloh	T. Kubiak, U.S. FWS J. Ludwig, Consultant	2 Years

Objectives:

To develop better methodology to detect embryonic death, congenital abnormalities and other manifestations of reproductive toxicity.

Scientific Rationale and Program Relevance:

Recently, the need to detect the illegal presence of incubator reject eggs in liquid whole eggs destined for human consumption in North America, has resulted in the discovery that the presence of 3-hydroxybutyric acid (3-HBA) can be used as an indicator of fertility and embryonic development. Although, its presence will not allow the determination of the age of the embryo at death, its presence clearly separates those eggs which are infertile from those in which the embryo died. Prolonged incubation and microbial degradation after embryonic death do not significantly confound the results. 3-HBA is a marker of embryonic metabolism and not of incubation per se.

Since this enzyme has been detected in developing eggs of chickens, ducks, quail and turkeys, this is not a species-specific phenomenon and should therefore be useful in separating infertile from fertile and early embryonic deaths in field-collected samples of wild bird eggs, including those that are addled and/or rotten. A simple, spectrometric NAD-coupled enzymatic assay is currently in use by the poultry industry to detect 3-HBA for this purpose.

Reproductive toxicity may be mediated via the male, the female, or the embryonic milieu. In birds, infertility may result from abnormal reproductive behavior of either sex, testicular toxicity, or more rarely through the female. Embryonic failure may result from abnormal incubation behavior, genotoxicity, abnormal eggshells, or the presence of developmental toxins within the egg. Adequately incubated eggs which fail to hatch in nests of wild birds may represent any one of four categories: (1) unfertilized eggs; (2) fertilized eggs which fail to develop beyond the earliest stages of cell division; (3) fertilized eggs which stop developing within the first few days of incubation; and (4) those containing embryos which die at later stages. In addition, the eggs will frequently

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:

Project Title: Avian Liver Cell Culture Studies of the Mixed Function Oxidase and Porphyrin Inducing Potencies of Polyhalogenated Aromatic Hydrocarbons.

88/89 Project No.: ~~TOX-TR-3~~

Project Leader: S. Kennedy

Region: NWRC

<u>CMS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
S. Kennedy HQ R. Norstrom HQ	Contract Biologist Summer Student	24 months

Objectives:

To continue studies to determine the mixed function oxidase and porphyrin inducing potencies of mixtures of polyhalogenated aromatic hydrocarbons (PHAHs) and of selected PHAHs in primary chicken embryo liver cell cultures and to determine the potential of the approach in predicting the toxicity of environmental mixtures of PHAHs to birds.

Scientific Rationale and Program Relevance:

The hazard of present environmental levels of PHAHs to wild birds is unknown. In vivo experiments are often prohibitively expensive (and can certainly not be conducted with every species) and new techniques to determine the toxicity of complex environmental mixtures of PHAHs are required. Mixed function oxidase and porphyrin induction by PHAHs in cell culture offer promise as a predictive tool, and we plan to explore this potential. Results with chicken embryo liver cells (a system with which we have experience) will be compared to literature results with rat hepatoma H-4-II E cells (Safe, et. al.; and Bradlaw and Casterline) and with our in vivo experiments with PCB congeners in Japanese Quail (Elliott and Kennedy).

Project Description, Work Plan, and Anticipated Results:

To produce two reports on the toxic chemical situation in the Great Lakes as it has evolved over the last two decades. The information must be scientifically credible and of a level that could be presented to a plenary session of a scientific conference. A synopsis report will be written in a style and format understandable to the general public.

A joint DOE, NH&W and DFO Steering Committee, under the chairmanship of Denis Davis (DG/IWD) will provide overall direction to the project. The taskforce responsible for the production of the reports is chaired by David Peakall. Rod Allan is responsible for report one; second report will be produced jointly by the three departments. NHW is represented by David Villeneuve, DFO by John Cooley and CWS by David Peakall. The synopsis report will be drafted by Darrell Piekart (C & P, Ont. Reg) and circulated to the taskforce for comment before being sent to the Steering Committee for approval.

Work schedule.

April 30.	Completion of report one.
May 31.	Completion of report two.
June 30.	Completion of synopsis report.
September 30.	Publication of reports.

Budget Estimate:

2K. Since it does not involve any new studies, the costs will be largely in time. Travel costs to Toronto/Burlington (2K). Costs of publication (estimated at \$40K) to be covered by C&P and/or Ontario RDG's office.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:

Project Title: Biochemical approaches to the differential diagnosis of bird exposure to organophosphates and carbamates.

88/89 Project No.: TOX-TR-2

Project Leader: S. Kennedy

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
S. Kennedy HQ S. Trudeau HQ	Contract Technician	24 months

Objectives:

1. To continue studies to determine the value of chemical reactivators (e.g., pyridine 2-aldoxime methiodide, 2-PAM) of cholinesterase to discriminate between bird kills due to organophosphates from kills due to carbamates.
2. To conduct feasibility studies to determine the possibility of direct detection of organophosphate-induced phosphorylation at the active site of acetylcholinesterase in field-collected samples.

Scientific Rationale and Program Relevance:

Wild birds are frequently exposed to (and poisoned by) organophosphate and carbamate pesticides. Due to the instability of these chemicals it is often difficult to detect residues in the carcasses of the birds, and biochemical approaches to assess exposure are often used.

The traditional approach to biochemically demonstrate bird poisonings by organophosphate and carbamate pesticides has been to assay brain acetylcholinesterase activity. We conduct this assay at NWRC. The approach has limitations, however. It will not discriminate between organophosphate- and carbamate-induced poisonings, and unless the activity is severely depressed, control brain tissue which has been collected and stored under identical conditions is required for comparison. We, therefore, plan to determine the value of several alternative approaches to the differential diagnosis of poisonings due to cholinesterase inhibition. We will continue to evaluate the potential of chemical reactivators to discriminate between poisonings due to organophosphates and carbamates (a 1987-88 Pestfund project), and continue studies to determine if it is possible to detect unambiguous indicators of organophosphate-induced inhibition at the catalytic site of cholinesterase.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:~~Project No.:~~ ~~PE-1~~

Project Title: Pesticide registration reviews of new active ingredients and research permits in support of PCP Act.

Project Leader: K. Lloyd

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
P. Mineau A. Baril D. Boersman K. Lloyd Vacant	DFO CCB, Pesticides Directorate, EP Agriculture Canada Health and Welfare Canada Wildlife Toxicology Regional Groups	Ongoing

Objectives:

Complete 12 major reviews of new active ingredients, as well as reviews of applications for research permits, and preliminary reviews of new data packages.

Scientific Rationale and Program Relevance:

The role of CWS is to evaluate the technical submissions from industry as well as review pertinent open literature in order to assess hazards that these products may pose to wildlife, identify information gaps requiring additional research, monitoring actions, etc., and to advise Agriculture Canada and other pesticide regulatory agencies, the registrants, and pesticide users about these concerns and how to redress them.

All pesticides used in Canada must be registered under the Pest Control Products Act, administered from Agriculture Canada. Environment Canada through an MOU is committed to providing technical support to Agriculture Canada on pesticides. Prevention of unnecessary impacts through participation in the federal pesticide registration review process is a cost-effective wildlife resource and environmental quality protection strategy.

.../2

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~PE-2~~

Project Title: Special reviews of pesticide impacts on wildlife for registered pesticides identified as a priority by CWS.

Project Leader: K. Lloyd/P. Mineau

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
A. Baril K. Lloyd P. Mineau Vacant	DFO CCB, Pesticides Directorate, EP Agriculture Canada Health and Welfare Canada Wildlife Toxicology Regional Groups	

Objectives:

Continue special reviews on carbofuran flowable, fenitrothion, diazinon, diquat, fenthion and atrazine.

Scientific Rationale and Program Relevance:

Of those pesticides already registered for use in Canada, some are identified as of special concern to CWS due to impacts on wildlife. In order to determine the magnitude of the impact, CWS must review the pertinent open literature, identify information gaps and co-ordinate additional research and monitoring actions, in order to advise Agriculture Canada and other pesticide regulatory agencies, the registrants, and pesticide users about those impacts and how to redress them.

During the registration process, some pesticides are predicted to pose a risk to wildlife. Should those pesticides become registered and used in Canada, information on actual impacts occurring in the field must be collected in order to advise Agriculture Canada on actions required to mitigate those impacts.

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989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CE-1~~Project Title: Priority and new substance hazard evaluations.Project Leader: Head, Contaminants Evaluation
Section (Vacant)Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
Vacant	Commercial Chemicals Branch	Ongoing
G. Fox	NHW-EHD; DFO	
Vacant		
B. Braune (Term)		
J. Elliott (Transferring)		

Objectives:

To review hazards to wildlife of substances on the CEPA Priority Substances (Assessment) List, Schedule I (CEPA) or of priority concern to CWS and to contribute to preparation of formal assessment reports on these substances.

assess hazards to wildlife of new substances notified under provisions of CEPA.

To develop environmental quality objectives for wildlife and report on chemical state of wildlife environment.

Scientific Rationale and Program Relevance:

The hazards to wildlife, from toxic chemicals and other substances are identified by critical review of all available scientific and technical information. Recommendations are made on the significance of the risk and the need for regulatory action under provisions of CEPA (II). Information gaps are also identified and priorities for direction of research by Section 18 CEPA or by in-house means, wildlife toxicology fund, etc., are also recommended.

Reviews of the literature on effects of substances are also used to set Environmental Quality objectives for wildlife. Analyses of the available exposure/effects data and relevant bioeffects monitoring information are used to report on state of the chemical environment of wildlife.

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1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~PE-4~~

Project Title: Evaluation of the utility of the avian reproduction studies currently provided as part of pesticide registration.

Project Leader: P. Mineau

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
P Mineau D. Boersma B. Collins	Programmer, Contract Writer	3-4 Years - 1987

Objectives:

1. To evaluate the usefulness of the EPA-Designed Avian reproduction protocols for assessment of hazard posed by chronic exposure to pesticides.
2. To determine if it is more useful for this purpose than the mammalian chronic studies routinely provided.
3. To determine how the design could be improved or suggest alternative testing strategy.

Scientific Rationale and Program Relevance:

Before we can write comprehensive guidelines for environmental toxicology testing and evaluation, we must determine the usefulness of the current components. The avian reproduction study is the most expensive laboratory test currently carried out in environmental toxicology. The test was designed to detect shell-thinning and other impacts of chlorinated hydrocarbons rather than the short-lived neurotoxins and herbicides of concern today.

- Results of our analysis to date indicate that there are serious problems in the interpretation of the results from these studies, the main problems being the separation of a true reproductive effect from that of maternal toxicity and the unknown comparability of the different statistical analyses which have been performed on the results of studies on different pesticides. At this stage, we believe that it is most relevant to establish a set of analysis and evaluation criteria that can be used to determine whether these studies demonstrate an effect or not. Such criteria are needed if the results of the different avian studies are to be compared among each other let alone compared to endpoints in mammalian reproductive or chronic toxicity studies.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:~~Project No.:~~ ~~PE-6~~

Project Title: The sublethal effects of an organophosphate insecticide on learning and memory in birds.

Project Leader: P. Mineau

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
P. Mineau(3.5 pers.mo.)	Drs. Boag, Beninger,	1 yr. - Jan. '89-
S. Kennedy(0.25 pers. mo.)	Ratcliffe & Harmsen**	Jan. '90
S. Trudeau (0.5 pers. mo.)		

** Doctoral committee members of project leader, Queen's University.

Objectives:

To look at the effect of sublethal dosing with a cholinesterase-inhibiting insecticide on short-term memory and learning in birds.

Scientific Rationale and Program Relevance:

Considerable controversy surrounds the use of organophosphate and carbamate insecticides. Of prime importance in the evaluation of the impact of these compounds on wildlife species is the extent to which sublethally exposed individuals are compromised.

Evidence from the laboratory mammal and human poisoning literature suggests that exposure to anti-cholinesterase agents can disrupt higher behavioural processes such as learning and memory. Furthermore, exposed animals which appear to have recovered from an acute exposure, at least in terms of gross motor function and other visible symptoms of toxicity are often found to still be functionally impaired when tested for these more complex brain functions.

Yet, despite evidence that large numbers of wildlife are exposed to anti-cholinesterase agents in forestry and agriculture, there have not been any attempts to look at possible impacts of sublethal exposure on learning or memory. Functional impairment of either of these processes, even if temporary in nature, would seriously jeopardize the recovery of exposed individuals and their return to pre-exposure status.

A substantial amount of work on memory in birds has been achieved through the use of food caching behaviour in certain groups, notably the Paridae (Tits or Chickadees). Caching behaviour is highly repeatable and can be studied in a laboratory environment under controlled conditions. This behaviour is very important in nature because it provides a buffer against food scarcity in a variable environment.

We propose to use this useful model of memory in birds to look at the sublethal impact of fenitrothion, a commonly used forest insecticide, on the Black-capped Chickadee (Parus atricapillus). Because learning and memory are behavioural functions which are very important to the survival of any higher organism, we believe that our findings will have important ramifications to the study of the impacts of anti-cholinesterase agents in general.

Project Description, Work Plan, and Anticipated Results:

1988-89

Work on project commenced in January. Collection of chickadees, and their acclimation to holding cage and feed was completed in February. First experiment with maximum challenge dose began in March.

1989-90

Completion of the first experiment and extension of the work depending on results.

Work Plan:

1. Complete first experiment with maximum challenge dose to look at adequacy of test system by end of June.
2. Depending on results obtained, run lower doses or different pesticides.

Anticipated Report (Expected Titles) Authorships):

Publishable paper - to be incorporated into PhD thesis for Mineau.

ANIMAL CARE COMMITTEE ADDENDUM: The project has been approved by two separate animal care committees: Health and Welfare Canada where the birds are housed and Queen's University.

Budget Estimate:

	<u>Person Months</u>	<u>O&M (\$'000)</u>
- A-base	3.5	11.0
	0.5	
- Other (specify) Wildl. Tox.		
Fund		22.9*
Queen's University		1.1*

* Grant runs February 1989 to February 1990.

Analytical Services Approved: Cholinesterase analyses.

brain: approx. 50
plasma: approx. 50

Canadian Wildlife Service - Headquarters

PROJECT SHEETS 1989-90

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BRANCH: Wildl. Toxic. & Surveys DIVISION: Toxicology Research Division

PROJECT LEADER: D.B. Peakall

1. PROJECT

- (a) Title: Biochemical methods to assess exposure of birds to toxicants.
- (b) Description: Development of improved method of determining cholinesterase activity; tissue culture studies on induction of Mixed Function Oxidase and porphyrin; action of chemicals on DNA. Production of major overview report on Great Lakes.
- (c) Rationale: Cholinesterase activity is the main way of assessing exposure to two major groups of insecticides; cell-culture techniques allow more experiments with fewer animals; DNA changes are fundamental to organism health.
- (d) Duration: Ongoing.

2. PARTICIPANTS

Name	Group	Responsibility Centre	% Time
S. Kenndy	RES-1	Toxicology Research Div.	100
D. Peakall	RES-4	Toxicology Research Div.	50
S. Trudeau	EG-ESS-7	Toxicology Research Div.	100

Other Participating AgenciesOak Ridge National Laboratory; Carleton University3. GOALS:

- (a) C&P Program Toxic Chemicals
- (b) C&P Program Effect Harmful impacts are controlled.
- (c) Long Term Goal (from LTOP) 1.3 and 2.1
- (d) Budget Year Goal 1..3, 1.3.4, 2.1, 3.1

4. MARKETING/COMMUNICATION PLAN:

- (a) Target Groups Great Lakes Report will be targeted at both general public and scientific community. All other projects to the scientific community.
- (b) Strategy Great Lakes report will be available as a synopsis, and two technical reports. Other projects will be reported in the scientific literature.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project Title:88/89 Project No.: ~~TOX-TR-1~~DOE Report: Effects of toxic chemicals in the
Great Lakes ecosystem.Project Leader:

Peakall

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
Peakall,	. Cooley, DFO Villeneuve, NH&W Piekart C&P, Ont. Reg.	1 year

Objectives:

To produce two authoritative technical reports, one on the levels of toxic chemicals in the water, sediments and biota and the other on the effects of toxic chemicals on the biota of the Great Lakes and an non-technical synopsis report.

Scientific Rationale and Program Relevance:

The decision has been made that the Department will produce these reports on the Great Lakes.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project Title:

Studies of pollutant effects on DNA.

88/89 Project No.: TOX-TR-4Project Leader:

Peakall

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
Peakall Weseloh Fox	Shugart, Oak Ridge Kubiak, US F&WS Ludwig, Ecol. Res. Serv.	1 Year

Objectives:

To assess the value of three methods (occurrence of strand breaks, formation of adducts, and % 5-methyl cytidine) to indicate the effect of pollutants on the structure and function of DNA.

Scientific Rationale and Program Relevance:

Preliminary experiments carried out in co-operation with Dr. Lee Shugart of the National Laboratory at Oak Ridge has shown that the number of breaks in DNA (as measured by the degree of alkaline unwinding) and the number of adducts of benzo(a)pyrene are increased in a dose-dependent manner in Herring Gulls and Puffins exposed to oral doses of crude oil. A third technique, the rate of occurrence of 3-methyl cytidine, as index of the degree of repair to DNA is planned to be undertaken before the end of 1988/89. These preliminary findings indicate that these techniques could be used to measure the exposure of birds to polynuclear aromatics and could be used to expand monitoring programs to include this class of chemicals.

Studies have been carried out on the livers of young Double-crested Cormorants and Herring Gull collected from Lake Ontario and Bay of Fundy. Studies are being carried out on the rate of occurrence of abnormalities in Double-crested Cormorants by CWS Ontario Region. Studies on DNA will enable us to examine this phenomenon at the molecular level.

CANADIAN WILDLIFE SERVICE
WILDLIFE TOXICOLOGY AND SURVEYS BRANCH
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SECTION VII: CHEMISTRY RESEARCH:

ROSS NORSTROM

997-1411

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CR-1~~Project Title: Contaminant Dynamics and Trends in Great Lakes Herring Gulls.Project Leader: R. J. NorstromRegion: NWRC

<u>C'S Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
R.J. Norstrom (HQ)	C. MacDonald (Contractor)	Dioxins - ongoing
M. Simon (HQ)		Model - 1981-91
M.J. Mulvihill (HQ)		
D.V. Weseloh (ONT)		
C. Bishop (ONT)		

Objectives:

Determine levels of dioxins and furans in Herring Gull eggs collected from monitoring and special colonies. Apply model and pattern-recognition analysis techniques to interpretation of long-term temporal and geographical trends of organochlorines in Herring Gulls and the Great Lakes aquatic ecosystem.

Scientific Rationale and Program Relevance:

The Herring Gull Surveillance program of the Great Lakes Water Quality Program (GLWQP) has an extensive set of data on geographical and temporal trends of persistent organochlorine contaminants in the Great Lakes. This data set is one of the most important in determining the effects of regulatory action on the improvement of water quality in the Great Lakes. Many data have yet to be published, such as trends of OCs (including PCDDs and PCDFs) in Lake Ontario and Lake Michigan from 1971-82 from analysis of archived gull eggs. Quantitative interpretation of these data in terms of real trends in other components of the lakes in which the gulls are breeding, such as fish or water, has been made easier by development of a model. This model allows comparison of chemical levels in gulls to those in food species, and provides an analysis of sensitivity to ecological variables among the colonies, such as degree of winter movement, foraging efficiency during breeding, inclusion of human garbage in the fall diet, and so on. A Lotus 1-2-3 version of the model has been developed which will simplify the model application to "real" conditions, and make it more accessible to other researchers.

Project Description, Work Plan, and Anticipated Results:

Since 1984, PCDDs and PCDFs have been measured annually by the Chemistry Research Division in a pooled sample of eggs from each of the 13 routinely monitored herring gull colonies in the Great Lakes. Long-term trends (1971-1982) of PCDDs, PCDFs, ¹²⁵B congeners and organochlorines in Lake Ontario and Lake Michigan archived Herring Gull egg samples have also been determined. These data will be submitted to pattern-recognition analysis and a draft publication written.

Project Description, Work Plan, and Anticipated Results: (Cont'd)

A bioenergetics model and a two compartment contaminants model with parameters for organochlorines was developed to simulate bioaccumulation of the major contaminants in Great Lakes Herring Gulls. Four papers have been published.

Data on clearance of individual PCB congeners in Aroclors 1254 and 1260 from juvenile gulls has been analyzed to determine plasma clearance rates and plasma/fat partition coefficients and a draft publication completed. A final paper will be submitted. Biomagnification factors (BMFs) of a number of PCB congeners from forage fish to gull have been determined, and a paper published. These data will be analyzed by pattern recognition analysis to extract structure-clearance rate relationships.

Data obtained in 1978 on accumulation of PCBs, DDE, dieldrin and HCB in pre-fledged juvenile herring gulls from Chantry Island, Lake Huron, has been analyzed and compared simulated uptake using the model. A paper has been drafted and will be completed.

The large version of the model on the HP-1000 at NWRC has been adapted to run as a Level 1-2-3 model. Model output will be compared to field data to determine best ecological parameters for herring gulls in Lake Ontario (% fish in diet, daily energy requirements of most representative forage species). The validated model will then be applied to determine effects of seasonal movements, lipid content and diet changes on contaminant levels in eggs.

Work Plan: C&P Program 3.3 Toxics -C16 (3304)

- a. Determination, interpretation and reporting of levels and trends of dioxins, co-planar PCBs, PCB congeners and/or organochlorine compounds and heavy metals in wildlife.
- b. Specific studies in Great Lakes (gulls, cormorants, etc.).

Performance Indicators. Prepare a manuscript on dioxins and furans in wildlife in Great Lakes by May 1990. Complete analysis of 15 pooled herring gull eggs from Great Lakes report to CWS Ontario Region by December 1988. Prepare draft of a manuscript on contaminants in herring gulls by December 1989.

Budget Estimate:

	<u>Person Months</u>	<u>O&M (\$'000)</u>
- A-base	5 PM	\$60
- Other (specify)		

ANALYTICAL SERVICES APPROVED: No routine (dioxin only).

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:~~Project No.:~~ ~~CR-2~~Project Title: Dioxins in WildlifeProject Leader: R. J. NorstromRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
R.J. Norstrom (HQ)	Inst. d'Ecotox. St. Laurent	1982 - ?
M. Simon (HQ)	U.S. F&WS	
M.J. Mulvihill (HQ)	DFO	
Regional Contam. Biologists (ONT)		

Objectives:

Determine levels and sources of PCDDs and PCDFs in wildlife in order to assess their effects on wildlife, contamination in wild foods, and determine PCDD and PCDF distribution in the Canadian environment.

Scientific Rationale and Program Relevance:

Dioxins (PCDDs) and furans (PCDFs) are a group of the environmental contaminants of considerable concern. These classes of chemicals (there are 75 CDDs and 135 CDFs) are formed as by-products in the manufacture of other chlorinated organics, such as chlorophenols and PCBs, and are highly persistent. A few members have extreme acute toxicity (e.g., 2378-TCDD). Large amounts of chlorophenols are used in British Columbia as a fungicide to prevent staining of lumber. TCDD and TCDF are produced in the chlorine bleaching process of draft pulp mills. These same compounds have been shown to be lethal to chicken embryos at the several hundred part-per-trillion level. Great Blue Herons in several areas in B.C. have been found to contain high levels of hexachloro-, pentachloro- and tetrachloro- dioxins. One colony failed to produce young in 1987 and 1988. Embryotoxicity has been ruled out, but behavioural factors may be involved. Little is known about dioxin contamination in wildlife outside of B.C. and the Great Lakes, therefore further work in other regions of Canada is required.

There is a necessity to determine dioxins in some fish-eating ducks which are potentially consumed by humans.

Dioxins have been identified for priority assessment under CEPA.

Project Description, Work Plan and Anticipated Results:

Details of the 1989 sampling and analysis program are contained mainly in other CWS HQ and regional toxic chemical projects (8905, 8906, 8908 8917, 8917, 8918, 8919, 8926, 8927 and 8932). In addition to these projects, about 30 analyses will be directed towards

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Project Description, Work Plan, and Anticipated Results: (Cont'd)

high priority joint projects in the St. Lawrence River (beluga whale), Fraser River (chinook salmon survival project), Strait of Georgia (killer whale and harbour porpoise), Fraser River and the arctic (marine mammals). A total of 150 analysis for PCDDs and PCDFs have been identified. Because of the extra time involved in toxicology analysis, a contractor is required to achieve this level of productivity.

Work Plan: C&P Program 3.3 Toxics - C16 (3304)

- a. Determination, interpretation and reporting of levels and trends of dioxins, furans....in wildlife.
- b. Specific studies in St. Lawrence R. and estuary, Great Lakes (gulls, cormorants, etc.), Fraser River estuary (G.B. Herons, etc.), Arctic (Polar Bears, etc.)....

Performance Indicators. Prepare two manuscripts on dioxins and furans in wildlife by March 1990. Complete about 150 dioxin/furan residue measurements in selected wildlife according to schedule.

Budget Estimate: (See NOTE in study sheet CR-5 re 1990-91 estimates).

	<u>Person Months</u>	<u>O&M (\$'000)</u>
- A-base	24	65
- Other (specify)		

ANALYTICAL SERVICES APPROVED: No routine (dioxin only).

1990 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CR-3~~Project Title: Qualitative GC-MS Identification of Contaminants in Wildlife.Project Leader: R. J. NorstromRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
R.J. Norstrom (HQ) M. Simon (HQ) A.J. Mulvihill (HQ)		Ongoing

Objectives:

Analyze and report on significant new contaminants identified by GC-MS in wildlife from selected areas.

Scientific Rationale and Program Relevance:

Qualitative GC-MS analysis helps to identify the types and levels of contaminants bioaccumulating in sensitive Canadian species and ecosystems. In long-standing monitoring programs such as that for Herring Gulls in the Great Lakes, it functions as an "early-warning" for emerging environmental contamination problems. GC-MS analysis of Herring Gull eggs has been used to good advantage in the past to identify a number of important contaminants in the Great Lakes, such as photomirex and TCDD in Lake Ontario. Since the reinstitution of a annually rotating "intensive study lake" protocol, full scan GC-MS analysis of pooled samples from the monitoring colonies on that lake has been performed each year.

Project Description, Work Plan, and Anticipated Results:

Herring gull eggs from the 1989 "intensive" Great Lake will be analyzed by full-scan GC-MS. In addition to confirmation of the presence of known residues (e.g., PCBs, DDE, dieldrin), other bioaccumulating organochlorines which may be present will be identified. The findings will be reported to CWS-OR/IJC-Great Lakes Water Quality Board.

Selected biota from across Canada will be analyzed by full-scan GC-MS as required.

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1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:Project No.: ~~CB-4~~Project Title: Toxic PCBs in the environment.Project Leader: R. J. NorstromRegion: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
R.J. Norstrom (HQ) M. Simon (HQ) M.J. Mulvihill (HQ)	D. Muir DFO	1989 - ?

Objectives:

To determine the presence of toxic (coplanar) PCBs in wildlife, and their significance relative to dioxins and furans.

Scientific Rationale and Program Relevance:

Coplanar PCBs (those with no ortho-chlorine substitution) have toxicities similar to those of dioxins, and much higher than those of most PCBs. Some partial-planar (one ortho-chlorine) PCBs have low levels of activity as well. These congeners are minor in commercial Aroclors, but may constitute a very large percentage of the total potential toxicity in the PCB mixture. Coplanar PCBs have been identified in Forster's Terns in Green Bay, Wisconsin, and were thought to contribute most of the dioxin-like teratogenic effects found in tern embryos and chicks. A system of "toxic equivalents" (equivalent to 2,3,7,8-TCDD) has been developed from in vitro enzyme assays, which may allow concentrations of coplanar PCBs and other dioxin-like compounds to be interpreted in a more toxicologically meaningful way. Thus, it is important to be able to measure total toxic equivalents, rather than just total PCBs, in monitoring programmes.

Project Description, Work Plan, and Anticipated Results:

The basis of specificity for dioxins in the CWS dioxin methodology is the Stalling/Smith carbon column, which has a particular affinity for planar, multi-ring aromatic compounds. Since coplanarity is also the basis of toxicity for PCBs, the toxic PCBs can be separated from the non-toxic PCBs using similar methodology. Smith and Schwartz of the U.S. F&WS, and Tanabe's group of Ehime University, Japan, have independently worked out procedures for coplanar PCB enrichment based on carbon columns. Enrichment is required to eliminate interference from PCB congeners which are present at much larger relative amounts, and interfere with analysis of the coplanar PCBs. Using the two procedures already developed as a guideline, the CWS dioxin method has been modified and tested for suitability as an enrichment technique for routine application to wildlife samples. Dr. D. Muir of the Freshwater Institute, DFO, Winnipeg, is cooperating in development of the methodology.

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Project Description, Work Plan, and Anticipated Results: (Cont'd)

The method will be applied to a selection of wildlife which are known to have relatively high PCB and/or dioxin levels. Approximately 60 analysis are anticipated. The recently acquired GC/MSD will be used for some or all of these analyses.

Work Plan: C&P Program 3.3 Toxics - C16 (3304).

Performance Indicators. Complete development of coplanar methodology by March 1990 (and apply to about 60 selected samples).

Budget Estimate: (See NOTE in study sheet CR-5 re 1990-91 estimates).

	<u>Person Months</u>	<u>O&M (\$'000)</u>
- A-base	6	20
- Other (specify)		

ANALYTICAL SERVICES APPROVED: None required.

1989-90 WILDLIFE TOXICOLOGY STUDY SHEET:

Project No.: CR-5

Project Title: Long-Range Transport and Accumulation of Organochlorine Contaminants in Arctic Marine Ecosystems.

Project Leader: R. J. Norstrom

Region: NWRC

<u>CWS Project Personnel</u>	<u>Other Co-operators, their affiliation</u>	<u>Project Duration</u>
R.J. Norstrom (HQ)	NWT, Provinces, USA, Greenland, possibly Norway and USSR	Every 5-10 years

Objectives:

Determine circumpolar geographical distribution of persistent organochlorine contaminants in the Polar Bear; determine 5 year trends in contamination in the Canadian Arctic.

Scientific Rationale and Program Relevance:

It has been suggested that the Arctic Ocean may eventually become one of the principal sinks of the atmospheric and oceanic burden of organochlorines. GC/MS analysis of 1982-84 Polar Bear samples showed that the patterns of contamination were similar in most respects to North Atlantic air 5-8 years before. Relatively high levels of PCBs and the pesticide metabolite, oxychlordane, were present, along with lesser amounts of DDE, Dieldrin, HCB and α -HCH. Levels of most OCs in Hudson Bay and Baffin Bay Bears increased in the 1969-1984 period, therefore it is important to establish if this is a long-term trend. It is proposed that samples from the Canadian Arctic/sub-Arctic be analyzed approximately every 5-10 years, including areas not covered by the previous survey (Manitoba, Ontario and Quebec). Knowledge of the circumpolar distribution of contaminants is also important in determining the sources, trends and potential significance of these contaminants to Arctic marine and maritime wildlife.

Project Description, Work Plan, and Anticipated Results:

The geographical distribution of OC contaminants in fat and liver, and heavy metals in liver, was determined in 12 biogeographical zones throughout the Polar bear's range in the Northwest Territories in 1982-84. Levels of most OCs were generally inversely correlated with latitude, as expected for mid-latitude sources and relative isolation of the Arctic air mass. Bioaccumulation in the arctic marine food chain Arctic Cod - Ringed Seal - Polar Bear was studied in cooperation with D. Muir of the Freshwater Institute, SFO.

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Project Description, Work Plan, and Anticipated Results: (Cont'd)

A proposal for a circumpolar survey of contamination in Arctic biota was presented and discussed at an international forum of polar bear researchers and managers in 1988. There was agreement in principal to proceed, and a principal contact person has been established for the USA, Greenland/Denmark, Norway and the USSR. Samples from the last countries may arrive at the beginning of 1989. A systematic collection in North America similar to the one performed in 1989, will be conducted in the winter of 1989-90, and analysis will proceed in 1990-91. CWS will perform the analyses, and the cooperating countries will provide samples of Polar Bear fat.

It is anticipated that 150-200 samples (fat only) will be analyzed in 1990-91.

Work Plan:

Specific studies in Arctic (Polar bears, etc.)

Performance Indicators. Complete manuscript contributions to Contaminants in the Arctic by December 1989.

Budget Estimate: NOTE: Resources for this program will greatly increase in 1990-91 when analysis of the samples will begin. Because of the research nature of the analysis this can only be accomplished in-house at the expense of dioxin and coplanar PCB analysis.

	<u>Person Months</u>	<u>OSM (\$'000)</u>
- A-base	1	1
- Other (specify)		

ANALYTICAL SERVICES APPROVED: None required.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: William H. Prescott Telephone: 506-536-3025
Title: A/Chief, Migratory Birds Management
Address: Canadian Wildlife Service
P.O. Box 1590
SACKVILLE, N.B. E0A 3C0.

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Migratory Bird Management - Monitoring
Research

Habitat Protection and Management - NWA + MBS
- Research
- Inventory

Env. Impact Assessment

Endangered Species Recovery & Monitoring

Toxic Chemical Research + Monitoring

LRTAP research & monitoring

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Division Chief

Project Title: Program Management - Migratory Birds Management

Project Coding: 4110 1100 14100

Participants: (Leader)
Vacant BI-5
D. M. Johnson CR-3

Abstract: A management function will be carried out relative to research, biological studies, monitoring, and enforcement functions originating in St. John's, Dartmouth, and Sackville. Priority will be placed on increasing enforcement staff and activities, and on rationalizing the seabird program. Human resource management, including classification reviews and career direction assessment, will also be emphasized.

Rationale: Program management is required to plan, implement, and expedite the activities of Migratory Bird Management programs in the region, ensuring that results of studies are made available expeditiously, within approved budgets and resources. Also included is encouragement of outside activities which contribute to conservation and management of migratory birds, and provision of information and advice to the public on migratory bird conservation issued and CVS programs.

Status:
Ongoing national activity.

Publications & Public Information Planned:
Internal documents only.

Agreements, Other Participating Agencies:
Concentrate on agreements with RCMP and other cooperating enforcement agencies.

Uncertainties (Funding, Cooperating Agencies, etc.):
All those identified for projects within program, plus those associated with the personnel involved.

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Non-game birds

Project Title: Non-Game Bird Surveys (Atlas, BBS, MNRS)

Project Coding: 4110 1100 14110 (MNRS, general)

Participants:	(Leader)
All Migratory Bird Staff, in course of work, Toxic Chemical staff, and many volunteers	T. Erskine

Abstract: Distribution of breeding birds in the Maritimes is being pursued through the grid-based Maritimes Breeding Bird Atlas, with volunteers coordinated by Nova Scotia Museum through a trust with financial support from CWS, DSS, and other sources. Trends in numbers are monitored through the cooperative Breeding Bird Survey, roadside surveys by volunteers coordinated regionally, and by CWS-HQ/USF&WS. Breeding data are being accumulated through the Maritimes Nest Records Scheme (Nfld. NRS is run by provincial museum), from volunteers, and professionals who find nests during their work and/or recreational activity.

Rationale: Assessment of environmental impacts on non-game birds depends on basic knowledge of their distribution, numbers, and productivity (as with other birds). With 150+ species involved, much of the needed information must be obtained peripherally to other work, or accumulated from volunteers participating in cooperative projects coordinated by CWS or other agencies. Most of these activities are pursued in various parts of Canada as well as in AR, with varying degrees of CWS support.

Status: The Atlas is in fourth year of a 5 year project of data collection (with write-up to follow). The BBS has been ongoing since 1966, although effort has varied greatly. The MNRS is ongoing since 1960.

Publications & Public Information Planned:

Atlas newsletter (from N.S. Museum) - 3 or 4/year; BBS reports not appearing since 1980 - need recovery; MNRS reports - annually to contributors; Heron Inventory - Progress Note anticipated in 1988-89.

Agreements, Other Participating Agencies:

Start-up funding for Atlas from DSS, and office support from NS Museum, etc. Data contributed to all schemes by provincial personnel and others.

Uncertainties (Funding, Cooperating Agencies, etc.):

Other funding - to pay full-time Atlas coordinator - still not ensured for succeeding years.

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Migratory Game Bird Surveys

Project Title: Duck population monitoring

Project Coding: 4112 1100 14270 (NS & PEI)
 4112 1100 14280 (NB)
 4112 1100 14300 (Nfld)

Participants:		(Leader)
M. C. Bateman	BI-3	M. C. Bateman (NS & PEI)
G. R. Parker	RES-2	G. R. Parker (NB)
I. Goudie	BI-2	I. Goudie (Nfld)
W. R. Barrow	EG-5	

Abstract: Breeding duck populations (except in P.E.I.) will be monitored by helicopter surveys in May of selected sample blocks (5 x 5 km in NB and NS, 10 x 190 km in Nfld.). In P.E.I., ground surveys in late April and late May of selected wetlands provide indices to trends in spring duck numbers. Summer surveys in P.E.I. will continue with more intensive coverage of fewer areas (as in 1987). Spring coverage as described was begun in 1983 in P.E.I., 1985 in N.B., 1986 in N.S., and 1987 in Nfld.

Rationale: The North American Black Duck population appears to be declining. Monitoring trends in the breeding population (of this and other species) is a national and international priority. The effects of harvest manipulations on breeding population are not well established. Breeding populations must be monitored (1) to detect population changes which may call for manipulation of harvest, and (2) to monitor effects of changes in harvest on the breeding population. Monitoring of productivity can provide additional insight into the relationships between banding populations and harvest and for productivity assessments of wetlands.

Status: Ongoing national/international activity

Publications & Public Information Planned: Technical reports will be written on all surveys.

Agreements, Other Participating Agencies: With the withdrawal of U.S. funding, CWS-HQ is supporting the N.S. and N.B. surveys, and DU is covering the cost of the Nfld. Survey.

Uncertainties (Funding, Cooperating Agencies, etc.):

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Endangered Species

Project Title: Harlequin and Peregrine Surveys - Labrador

Project Coding: 4112 1100 14320

Participants:		(Leader)
R. I. Goudie	BI-2	P. W. Hicklin BI-2
J. Brazil	Nfld. Wildlife Division	R.I. Goudie
D. Lemon	Nfld. Natural History Society	

Abstract: Northern Labrador is thought to be the centre of the breeding range of the Harlequin Duck in eastern North America. Aerial helicopter surveys in summers 1987 and 1988 yielded some of the first major data on extent and density of breeding there. This study proposes to extend similar surveys further south to determine extent and density of breeding there. A comprehensive report will be produced for public consumption. Simultaneously, a survey for the endangered Peregrine Falcon will be carried out.

Rationale: Very little is known of the actual extent and density of Harlequin Ducks breeding in Labrador. The population in eastern North America may be endangered due to over-exploitation on the winter grounds. It is critical to better define distribution and numbers in Labrador which has been considered the centre of its breeding range. Increasing resource development in Labrador highlights the need for a better data base to assess potential impacts to migratory birds. In 1987 and 1988, approximately the area from Nain north to Cape Chidley was surveyed. Numbers, density, and range of Harlequin Ducks breeding south of Nain are now very critical questions in order to corroborate data based on winter observations and distribution. Also, an additional year's monitoring of the Peregrine Falcon is required to determine its breeding status in Labrador. While focused on Harlequin Ducks and raptors, these surveys provide valuable additional information of distribution and concentrations of other waterfowl species such as significant concentrations of moulting waterfowl.

Status: Surveys were carried out in 1987 and 1988. The 1988 project will provide a relatively complete picture.

Publications & Public Information Planned: Status report to be submitted to COSEWIC. Reports for internal use and public consumption to be produced.

Agreements, Other Participating Agencies: Baseline studies funding from Regional Director General's office. World Wildlife Fund (Canada) is major supporter, and Nfld. Natural History Society and Newfoundland Wildlife Division are other participants.

Uncertainties (Funding, Cooperating Agencies, etc.):

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Migratory Game Bird Surveys

Project Title: Shorebird banding in the Bay of Fundy

Project Coding: 4112 1100 14330

Participants:		(Leader)
P. W. Hicklin	BI-2	P. W. Hicklin
R. G. Hounsell	EG-6	
Volunteers		

Abstract: This banding will be reduced to approximately 2000 birds with a change in emphasis to Yellowlegs, Dowitchers, and Black-bellied Plovers in keeping with agreement with Suriname. Surveys will be carried out to estimate numbers of Red-necked Phalaropes staging in the Bay of Fundy. On the basis of this census, an evaluation will be made of the suitability of the site as a Western Hemisphere Shorebird Reserve.

Rationale: A major effort is underway in North and South America to identify and protect staging and wintering areas of shorebirds. The Bay of Fundy is the most important fall staging area for the Semipalmated Sandpipers. Creation of "twinning" Hemispheric Shorebird Reserves in the Bay of Fundy and in Suriname would be supported by better evidence for the link between these areas. Local resistance to the banding program, along with the need for data on other species, have precipitated a change in emphasis. There exists no data upon which to assess the importance of the Bay of Fundy to migratory Red-necked Phalaropes or the suitability of the site for Hemispheric Reserve designation.

Status: Fourth year of a five year project (associated with international initiative).

Publications & Public Information Planned: Internal report on success of banding larger shorebird species.

Agreements, Other Participating Agencies: Volunteer assistance may be solicited.

Uncertainties (Funding, Cooperating Agencies, etc.): Timing and size of bird movements may vary with vicissitudes of arctic breeding; proposed funding is minimal and needs to be supplemented if possible.

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Seabirds Survey

Project Title: Monitoring population trends and breeding performance of seabirds in Atlantic waters

Project Coding: 4112 1100 14360

Participants:	(Leader)
D. N. Nettleship RES-3	D. N. Nettleship
J. W. Chardine EG-7	

Abstract: Long-term monitoring plans include species feeding at higher (fish) and lower (crustacean plankton) levels in the ecosystem, in high arctic, low arctic, and boreal oceanic zones. Baseline plots for monitoring are in place in all areas, although plots at some major colonies have still to be established. This year's work includes monitoring of trend in breeding Atlantic puffins in Newfoundland. A study of the distribution and status of Thick-billed Murre population breeding at Cape Hay and Cape Graham Moore, Bylot Island, N.W.T. Future requirements for population trends monitoring will be determined in part at an International Symposium in St. John's in April.

Rationale: The puffin monitoring project forms part of a long term monitoring program to study the influence of natural and anthropogenic factors. Changes in key demographic parameters identify problems related to the species welfare and indicate marine environmental change. Information to be gathered at Bylot Island is vital to the assessment of our population monitoring system for Thick-billed Murres. The seabird colony registry is required to render a large volume of seabird data accessible to investigators and managers.

Status: Overall program is ongoing, under development since 1972.

Publications & Public Information Planned: Report entitled "The Seabird Colony Database: Specifications and Demonstration." Reports on puffin status and PLI monitoring to be published in Technical Report Series.

Agreements, Other Participating Agencies: Arctic work depends on support (secured) from Polar Continental Shelf Project, and involves collaboration with CVS-HQ and CVS-WNR personnel.

Uncertainties (Funding, Cooperating Agencies, etc.): Shortages of funding and support staff are chronic, and jeopardize continuity of project.

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

<u>Region</u>	<u>Division</u>			<u>Section</u>
Atlantic	Migratory Birds Management			Waterfowl Research
Project Title:	Black Duck Research (general)			
Project Coding:	4113	1100	14400 (general)	
	4113	1100	14410 (Seymour)	
Participants:				(Leader)
G. R. Parker	RES-2			G. R. Parker
contractors				

Abstract: Rates of mortality and dispersion of Black Ducks produced on managed and heavily hunted wetlands at the Shepody NWA were measured by radio telemetry. Dispersion was minimal, and mortality from hunting during the first six weeks of the season was approximately 50% of birds available opening day. Loss from crippling approached 35% of total kill. These data will be interpreted relative to rates on unmanaged and less heavily hunted freshwater wetlands, typical of much of the Black Duck breeding habitat in the Maritimes. The Lepreau region represents such a study area. The distribution of breeding Black Ducks and subsequent broods within the Antigonish Harbour study area (described by Seymour in 1988-89 report) will be established by spring aerial and ground surveys. Emphasis will be placed on documenting comparative duckling production (broods/breeding pairs) and subsequent brood and duckling survival between coastal and inland wetlands.

Rationale: These data are essential in the long-term study of Black Duck populations and mortality in Atlantic Region. The distribution of breeding pairs and subsequent broods of Black Ducks was documented on a 600 km study near Lepreau, N.B., in 1986 and 1987. Pairs showed considerable fidelity to breeding sites between years. In 1988, approximately 20 local Black Ducks were banded there with use of dogs. It is reasonable to expect that, 50-60 local Class III Black Ducks can be captured and radio-marked. It is important to measure dispersion and mortality of this sample relative to the Shepody study. The Antigonish Harbour region represents a biologically rich and productive estuarine habitat. The study of waterfowl, especially Black Duck, has been conducted continuously since 1972.

Status: Third year of telemetry study; band recovery analysis requires updating every few years; contract study is in second year.

Publications & Public Information Planned: Internal progress reports primarily.

Agreements, Other Participating Agencies: Contract with St. Francis Xavier University for coastal waterfowl study. Some collaboration with provincial wildlife agency on harvest research may be possible.

Uncertainties (Funding, Cooperating Agencies, etc.):

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Waterfowl Research

Project Title: Populations, bioenergetics, and feeding ecology of the Common Eider in southwestern New Brunswick.

Project Coding: 4113 1100 14420 (Eider study)

Participants:	(Leader)
P. W. Hicklin BI-2	P. W. Hicklin
summer students	

Abstract: Field study of eider-Great Black-backed Gull interactions and populations will be conducted at The Wolves and St. Andrews Bay in southwestern New Brunswick. This will be the final year of a two-year field study. Banding of nesting female eiders and of ducklings will also be affected. Data analysis and write-up of the earlier work will continue throughout.

Rationale: Management of eiders requires knowledge of breeding populations and their movements, origins of wintering birds from elsewhere, use of local habitats by season, and the sites and timing of accumulation of nutrient reserves for breeding. Part of predicting the future dynamics of eider populations is the determination of production and sources of mortality. Mortality of ducklings by gulls in part determines the size of the effective breeding numbers of each cohort in the population. This information is important to assess future trends of these populations and environmental impacts of potential hazards such as oil spills, disturbance by tourists, and habitat degradation.

Status: Second year of two-year study.

Publications & Public Information Planned: Ph.D. thesis (U.W.O.), and scientific papers arising therefrom; internal species management recommendations.

Agreements, Other Participating Agencies: Student support shared by UWO (Zoology) and province (NBDNRE).

Uncertainties (Funding, Cooperating Agencies, etc.):

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Seabirds Research

Project Title: Research on breeding and feeding ecology of colonial seabirds.

Project Coding: 4113 1100 14430

Participants:		(Leader)
D. N. Nettleship	RES-3	D. N. Nettleship
J. Chardine	EG-7	
Contractor(s)		

Abstract: A computer model will be developed to predict the effects of hunting off Newfoundland and Labrador on Thick-billed Murres breeding in eastern Canada and western Greenland. A publication on the subject will be produced. A joint Canada/U.S. exercise will be continued to reintroduce the Atlantic Puffin to Maine.

Rationale: The Thick-billed Murre hunt off Newfoundland and Labrador is estimated to take about 13% of the total population annually, however, the potential effect of the hunt on the population has not been studied in detail. The model will allow the prediction of future population trends under current hunting pressure and estimation of the sensitivity of the results to variation in the input parameters. It will be particularly useful in identifying possible management techniques and evaluating their effectiveness. The project represents a long-term international conservation effort (CWS, USFWS, NAS) to enhance future prospects of the Atlantic Puffin in North America.

Status: The simulation study was begun in FY 87-88, and should be completed this year. The puffin reintroduction project began in 1973 and should be completed by 1993.

Publications & Public Information Planned: A simulation model for the management of the Thick-billed Murre in the N.W. Atlantic.

Agreements, Other Participating Agencies: The National Audubon Society is a major participant in the puffin transplant.

Uncertainties (Funding, Cooperating Agencies, etc.):
Technical support for the modelling exercise could become a problem.

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Migratory Birds Management	Seabirds Research

Project Title: Pelagic ecology of seabirds in Atlantic waters

Project Coding: 4113 1100 14440

Participants:	(Leader)
R.G.B. Brown RES-3	R.G.B. Brown

Abstract: Pelagic distributional data will be used to generate vulnerability maps to show where and when marine birds are at risk. Cruises (on BIO ships) will be undertaken to study the role of ocean fronts and upwellings in concentrating seabirds, with special emphasis on Georges Bank. Emphasis will be placed on determining near shore pelagic distributions of seabirds. Work on seabird/fisheries interactions will be monitored to determine the role played by seabirds in the total consumption of the fish resource. Future pelagic seabird ecology studies will be determined, in part through an international symposium in St. John's in April.

Rationale: Oil spills and other environmental emergencies happen in a hurry, and usually in ways that have not happened before. Advance assessment of vulnerability of marine birds to environmental threats is essential for their conservation. CWS should prepare a summary of the potential areas where birds are at serious risk, with emphasis on the nearshore where there is a paucity of information. There is a need to link seabird distributions more closely to specific marine communities in order to be able to predict effects of marine changes. Seabird interactions with fisheries is being emphasized within the university milieu and at DFO. CWS needs to be in a position to evaluate the effects of commercial fisheries on seabirds and vice versa.

Status: The seabird vulnerability gazetteer is a logical extension of the atlas of pelagic distribution of seabirds, a project ongoing since 1969; the investigation of marine fronts has been underway since 1982. Concentration on nearshore distributions and seabird/fisheries interactions are being given new emphasis.

Publications & Public Information Planned: The completed air-base atlas and the vulnerability gazetteer (contingency plan) for seabirds will be published for circulation to governments and industry; scientific papers will also result.

Agreements, Other Participating Agencies: Bedford Institute of Oceanography - use of ships and facilities.

Uncertainties (Funding, Cooperating Agencies, etc.): Funding for extraction of air-based distributional data from consultants' files is a problem ongoing since 1981.

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Wildlife Conservation and Environmental Quality	Wildlife Research

Project Title: Forest Bird Research

Project Coding: 4113 3106 14470

Participants:

D. G. Busby, BI-2

(Leader)

D. G. Busby

Abstract: The province of New Brunswick has requested that CWS undertake surveys of migratory birds in New Brunswick forest stands over a five year period. The information, along with detailed habitat data, will be used to build a model to predict impacts on wildlife habitats and therefore wildlife populations of different forest management strategies.

Work in 1987 involved a pilot study to determine the feasibility of the proposed techniques. A limited field application of the selected techniques was undertaken in 1988.

Rationale: Accelerated forest management, including renewal, protection, and silvicultural practices, will have profound implications for many wildlife species. Through stand manipulation and cutting regimes, forest management has considerable power to influence wildlife habitats. Over 100 species of birds occur in the forests of New Brunswick. The intention of the New Brunswick Department of Natural Resources and Energy to initiate a comprehensive forest habitat management program provides the opportunity for CWS to acquire the information needed to influence forest management strategies.

Status: 1988 was a pilot year of a proposed five year project.

Publications & Public Information Planned: Internal documents only at present.

Agreements, Other Participating Agencies:

New Brunswick Department of Natural Resources and Energy
DOE, C&P Atlantic Region, Baseline Studies

Uncertainties (Funding, Cooperating Agencies, etc.):

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Wildlife Conservation and Environmental Quality	Toxic Chemicals

Project Title: Toxic Chemicals - General and Pesticides
Impact of toxic chemicals and pesticides on migratory birds

Project Coding: 4124 3300 14770

Participants:	(Leader)
P. A. Pearce BI-3	P. A. Pearce
D. G. Busby BI-2	
N. Garrity EG-6	

Abstract: Major ecosystems (marine, estuarine, forest) are being monitored for accumulation of toxic chemicals, especially harmful ones. Efforts are also being made to remain aware of sources of dangerous chemicals so that wildlife resources in the vicinity can be monitored for impact. Advice is provided on the management of those chemicals as well as on spills and other emergency situations. The establishment and implementation of CEPA will require considerable input in 1989 and future years.

Studies will include the monitoring of the response of birds to pesticide spraying in forestry and agricultural practices. A continuing advisory role will be provided.

Rationale: The use and production of chemicals by our society continues to increase at alarming rates. Many of these chemicals are being used and/or released into the environment. Attempts are being made to control their use/release, especially the more toxic ones. Wildlife, being at a high trophic level, tends to act as an accumulator for some and react to dangerously high concentrations. This tendency to react can be used as an indicator of environmental health. The impact of those chemicals on wildlife populations is also important.

Status: Ongoing. Monitoring of ecosystems will continue. Marine ecosystems will be monitored in 1989. A system of advising, networking, coordinating, and general committee work will continue.

Publications & Public Information Planned: International documents only in 1989-90.

Agreements, Other Participating Agencies:
Conservation and Protection
Provincial Environmental Agencies

Uncertainties (Funding, Cooperating Agencies, etc.): The new Canada Environmental Protection Act will put additional pressures for advice and information on this project.

CANADIAN WILDLIFE SERVICE

PROJECT SHEET

1989-90

Region	Division	Section
Atlantic	Wildlife Conservation & Environmental Quality	Toxics

Project Title: Lead Shot Effects

Project Coding: 4124-3300-14780

Participants:		(Leader)
M. Bateman	BI-3	M. Bateman
J. Maxwell	EG-ESS-5	

Abstract: Sediment sampling at heavily hunted marshes in N.B., N.S., and P.E.I. will be carried out to add to the information collected in 1988 on presence of lead shot in marsh substrate. Technique will be similar to that used in 1988, but sampling design and intensity will differ. Blood lead content will be determined for 400 ducks (Black Ducks, Ring-necked Ducks) sampled on selected marshes. Pre-fledged birds as well as adults will be sampled at a sample of unhunted and heavily hunted wetlands. Gizzard collection from hunters will be carried out in all three provinces with assistance from the provincial wildlife agencies. The incidence of lead shot in gizzards will be determined as in 1988.

Rationale: This is the second year of a proposed two year study. Lead poisoning in waterfowl is a major concern in some heavily hunted areas of North America. Results from one study in the Maritime provinces (Daury, 1988) reported that 11 percent of Black Duck gizzards examined from Wallace Bay NWA and the N.S. south shore contained lead shot or had evidence of lead shot. Preliminary results from the current study indicated six percent of Black Duck gizzards in N.B. and 16 percent of Ring-necked Duck gizzards contained lead shot. The Canadian Wildlife Service is developing a national policy on the lead shot issue. Information on lead contamination in waterfowl resulting from ingestion of lead shot and the point or origin of the contamination is required to implement the policy.

Status: Second year of a two year study

Publications & Public Information Planned: Internal report. Public information may be required on unusually high lead in blood samples from Dartmouth ducks.

Agreements, Other Participating Agencies: Funded by Wildlife Toxicology Fund. Environmental Protection participating in follow up on high lead content in Dartmouth Black Ducks.

Uncertainties (Funding, Cooperating Agencies, etc.): Additional study requirements precipitated by high lead level readings.

<u>Region</u>	<u>Division</u>	<u>Section</u>
Atlantic	Wildlife Conservation and Environmental Quality	LRTAP

Project Title: The effects of acid precipitation on watersheds and wetland habitats in Nova Scotia.

Project Coding: 4125 3200 14800 (A-Base)

Participants:	(Leader)
J.J. Kerekes RES-3	J.J. Kerekes

Abstract: Main thrusts of the program are: (1) The completion of baseline characterization of aquatic bird populations of Kejimikujik National Park lakes representing a wide range of pH and colour to assess the effects of acid precipitation on water bird abundance, especially fish-eating birds. (2) Coordinating the Kejimikujik basins study, including the development of an integrated long-term multi-discipline program. (3) Completion of the publication of the Kejimikujik '88 Symposium. (4) Preparation of the final report on the sediment phosphorus regeneration study.

Rationale: Airborne transport of sulphur and nitrogen complexes is contributing "acid rain" to the region in substantial quantities. Given the generally poor buffering characteristics of the geological formation and the oligotrophic condition of the surface waters, acid rains may, over time, significantly reduce pH levels and in turn the productivity of surface waters. A decrease in the overall productivity of surface waters in the region could have significant implications to the productivity of aquatic migratory birds.

Status: Initiated in 1978 the Kejimikujik studies were generally completed in 1987 with the exception of the assessment of waterfowl initiated in 1988 and continued in 1989. A symposium was held on the Kejimikujik acid rain studies in October 1988. There is an ongoing advisory role in the Kejimikujik basin studies. The waterfowl and fish-eating bird population assessment will become part of long-term monitoring baseline for assessment of the effects of acid precipitation or other wide scale environmental disturbance.

Publications & Public Information Planned: Proceedings of the Kejimikujik '88 Symposium, a special volume of Water, Air and Soil Pollution will be published. Report on the 1988 and 1989 aquatic bird investigations in Kejimikujik National Park. A publication on loon population - fish production relationship in Kejimikujik National Park.

Agreements, Other Participating Agencies: Inland Waters Directorate. Kejimikujik National Park, Atmospheric Environment Service, Fisheries and Oceans, Nova Scotia Department of Lands & Forests, Canadian Forestry Service.

Uncertainties (Funding, Cooperating Agencies, etc.):
- availability of suitable field personnel (contractors), LRTAP B-Base funding.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORKSURVEY QUESTIONS

Your Name: Jean-Luc Desgranges

Telephone: 418-648-6126

Title: Research scientist

Address: 1141 route de l'Église
P.O. Box 10100
Ste-Foy, Quebec
G1V 4H5

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

-To provide information on the characteristics and presence of toxic chemicals in the environment, the pathways of these chemicals through ecosystems and knowledge of their actual and potential impacts on canadian wildlife.

-To provide information to consumers on the levels of toxic chemical residues in wild foods (especially waterfowl), and to make recommendations to prevent or cleanup the sources of contaminants in these wildlife.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project (s). Make additional copies of the form you wish.

3. Can you suggest the names of other federal environmental indicator reserchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water and land;
7. human exposure to toxic chemicals;
8. contaminants levels in food; or
- (9). exposure of fish and wildlife to toxic chemicals.

Name of Project Use of fledging osprey feathers to monitor Hg contamination in the Jame's Bay hydroelectric reservoirs.

Project objective (s) To evaluate the feasibility of using feathers from piscivorous birds to monitor Hg contamination of the food chain

Geographic scope (circle one) global
national
regional
local

If regional or local, what is the geographic area covered?

Jame's Bay and future hydroelectric reservoirs in northern Quebec

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water and land;
7. human exposure to toxic chemicals;
8. contaminants levels in food; or
- (9). exposure of fish and wildlife to toxic chemicals.

Name of Project Contaminant bio-monitoring program for the St-Lawrence river fauna.

Project objective (s) -Selection of bird species to be used for monitoring contaminant levels in St-Lawrence avian populations
-Research on indicators of sub-lethal toxicity to be used "in situ" to monitor the effects of toxic chemicals on the St-Lawrence fauna.

Geographic scope (circle one) global
national
regional
local

If regional or local, what is the geographic area covered?

St-Lawrence; but "environmental effects monitoring" indicators could be extended to other regions and to particular contaminants

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORKSURVEY QUESTIONS

Your Name: Patsy-Ann Thompson

Telephone: 418-648-5016

Title: Ecotoxicologist

Address: 1141 route de l'Église
P.O. Box 10100
Ste-Foy, Quebec
G1V 4H5

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

-To provide information on the characteristics and presence of toxic chemicals in the environment, the pathways of these chemicals through ecosystems and knowledge of their actual and potential impacts on canadian wildlife.

-To provide information to consumers on the levels of toxic chemical residues in wild foods (especially waterfowl), and to make recommendations to prevent or cleanup the sources of contaminants in these wildlife.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project (s). Make additional copies of the form you wish.

3. Can you suggest the names of other federal environmental indicator reserchers whom we should contact?

Claude Langlois

Centre Saint-Laurent
105 rue McGill, bureau 400
Montréal (Qc)
H2Y 2E7

Harm Sloterdijk

Same address

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water and land;
7. human exposure to toxic chemicals;
8. contaminants levels in food; or
- (9). exposure of fish and wildlife to toxic chemicals.

Name of Project Impact of dioxine/furan exposure from a BKM effluent on fish-eating birds of the St-Maurice river.

Project objective (s) -Impact of dioxine/furan contaminated food on the reproduction survival and health of migratory Herring gull and common merganser populations breeding in a river receiving bleached kraft mill effluents.
-Investigating the use of Mixed function oxidase induction in introduced Pekin ducks to monitor sub-lethal effects of dioxines and furans.

Geographic scope (circle one) global
national
regional
local

If regional or local, what is the geographic area covered?

Research is local but results could find more general use.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: J.F. Carreiro

Telephone: (613) 952-0931

Title: Chief, Wildlife Conservation and Environmental Quality

Address: 1725 Woodward Drive, Ottawa, Ontario K1A 0H3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Levels of contaminants in birds and their relationships to reproduction in order to develop indices of bioeffects and establish indicator species.

Levels of contaminants in different avian habitats, from wetlands, orchards and agricultural fields.

Indices are being developed to measure bioeffects: (Herring Gulls, Cormorants, Bluebirds and Kestrels).

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

You have already listed CWS' researchers working on environmental indicators.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Wildlife and Agricultural Pesticides in S. Ont.:
I. Bird usage of agricultural fields.

Project objective(s) To determine the species and abundance of birds
potentially at risk from the use of agricultural chemicals on selected
crop types in S. Ont.
In cooperation with Lands, to develop and apply a method for the
characterization of habitat/landscape patterns in the study area.
To publish a CWS technical report, a literature review on wildlife
use of agricultural habitats.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Wildlife and Agricultural Pesticides in S. Ont.:

II. Breeding biology parameters of swallows, bluebirds and kestrels nesting near apple orchards along the Niagara Escarpment.

Project objective(s) To determine the breeding biology parameters of nest box populations of swallows, bluebirds and kestrels near apple orchards in the Regional Municipality of Hamilton-Wentworth.
To determine organochlorine levels in the eggs of the above species.
To evaluate the comparative usefulness of the above three species as indicator species of exposure to agricultural organophosphate chemicals.
To determine the feasibility of a long term chemical and/or biological monitoring program from the impact of modern agricultural chemicals on wildlife.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Annual monitoring of contaminant levels and bioeffects
in fish-eating birds on the Great Lakes: I. Contaminant Levels in
Herring Gull Eggs.

Project objective(s) To determine and report on 1) the long term
temporal and spatial trends of selected contaminants in the eggs of
Herring Gulls from throughout the Great Lakes and 2) to submit for
publication a paper updating contaminant levels in Herring Gulls from
the Annual Monitor Colonies.
In cooperation with Headquarters, to develop a method of trend analysis
for a mixed data set comprised of contaminant levels based on individually
and pooled analyses.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project Annual monitoring of contaminant levels and bioeffects in fish-eating birds on the Great Lakes: II. Congenital anomalies in embryonic and post-hatch Double-crested Cormorants.

Project objective(s) To determine the fertility and hatchability of eggs of Double-crested Cormorants as well as frequency, stage of embryonic development and true rate of occurrence of developmental abnormalities (congenital anomalies) in Double-crested Cormorants on the Great Lakes.
To measure the rate of occurrence of developmental defects early and late in the incubation period by physical inspection and compare this to that found in embryos which have died as detected by the Embryonic Viability Detector.

Geographic scope (circle one) global
 national
 ☒ regional
 local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Annual monitoring of contaminant levels and bioeffects
in fish-eating birds on the Great Lakes: III. Breeding biology of
Herring Gulls and Forster's Terns in the Detroit/St. Clair River Corridor.

Project objective(s) To determine the breeding biology parameters of
Herring Gulls on Fighting Island and of Forster's Terns on Walpole Island.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ⑨ exposure of fish and wildlife ^{habitat} to toxic chemicals.

Name of Project

Lower Great Lakes Basin Wetlands at Risk

Project objective(s)

Identify and assess wetlands at risk from toxic chemicals and other stresses, and make recommendations on actions needed for the protection and rehabilitation of wetlands in the lower Great Lakes Basin.

Geographic scope (circle one)

global
national
⑨ regional
local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Wildlife support for Remedial Action Plans for
Great Lakes Areas of Concern.

Project objective(s) To provide information related to wildlife
populations and habitats and the effect of chemical and other stresses
on them for the preparation of RAPs.
To contribute to the preparation and review of the RAPs in order to
ensure wildlife interests are taken into account.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

Ontario

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Richard Pratt

Telephone: 613-952-0932

Title: Chief, Migratory Birds Conservation

Address: Canadian Wildlife Service--Ontario Region, 1725 Woodward
Drive, Ottawa, Ontario, K1A 0H3

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).

Surveys and research are conducted to sustain or increase migratory
birds that are shared
internationally.

Information is used to establish trends in bird populations and forces
that are affecting increases or declines. Hunting regulations are set
on the basis of the information, and habitat management programs are
developed/recommended.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ☒ 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Colonial waterbirds of the Great Lakes Basin (three-year project)

Project objective(s): To determine the levels (and population trends) of all species of colonial waterbirds inhabiting the Great Lakes basin. A three-year project undertaken jointly with the United States to establish baseline (state of the environment) levels for these birds.

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Great Lakes--Canadian side

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 - ☒ 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ☒ 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Ontario waterfowl population assessment

Project objective(s): To survey breeding waterfowl pairs throughout Ontario to assess breeding density, habitat preferences and community structure. To provide a baseline for examining population shifts either generally or as part of more local studies such as environmental impact assessments.

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Status of migratory birds (song birds)

Project objective(s): To develop a network of volunteers who will locate and monitor forest (song) birds, especially rare or scarce birds, as part of a forest bird monitoring program developed by CWS to measure trends

Geographic scope (circle one): global
national
① regional
local

If regional or local, what is the geographic area covered?

Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 - ⑥ levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 - ⑨ exposure of fish and wildlife to toxic(chemicals)?

Name of Project: Effects of acidic precipitation on waterfowl populations of northern Ontario

Project objective(s): To determine if acidity is limiting the abundance of major invertebrates and fish prey at critical stages in the nesting cycle. Work will lead to the establishment of biomonitoring regimes to assess the impact of reduced emissions on water quality and the biota supported.

Geographic scope (circle one): global
national
③ regional
local

If regional or local, what is the geographic area covered?

northern Ontario

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: *Lynne Dickson*

Telephone: *403 4638924*

Title: *Wildlife Biologist, Canadian Wildlife Service*

Address: *4999- 76 Ave
Edmonton, Alberta
T6B 2K7*

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Development of the oil and gas reserves in the Beaufort Sea may have a significant impact on the bird populations in that region. A priority of Environment Canada is to protect Canada's environment from degradation. The CWS also has a mandate under the Migratory Birds Convention Act to manage and conserve the migratory bird resource. One of the ways we accomplish this is to advise industry and government about the potential impact of proposed developments on birds. This monitoring study broadens our understanding of the effects of northern development on the migratory bird resource, thus improving our ability to predict and mitigate the impact of future development projects on birds. The monitoring study may also alert us to unpredicted impacts which can then be mitigated. Proper management of the Migratory Bird resource in the Beaufort Sea region will contribute to the social and economic well-being of the Inuit who harvest several bird species.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ☒ 1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

*Monitoring Study — Impact of Oil Development
on Birds in the Beaufort Sea region*

Project objective(s)

*To monitor the impact of off shore oil
and gas development on birds utilizing the Beaufort Sea
region by using the Red-throated Loon as an "indicator
species"*

Geographic scope (circle one)

global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Beaufort Sea region

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: STEVE WETMORE

Telephone: 604 946 2346

Title: CHIEF MIGRATORY BIRDS

Address: P.O. Box 340

DELTA

BC V4X 3Y3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

1) DATA IS COLLECTED TO MONITOR TRENDS IN POPULATION
LEVELS OF NATURAL BIRD SPECIES. DATA
COLLECTED TO ESTABLISH BASELINE LEVELS AGAINST
WHICH TO MEASURE FUTURE CHANGES AS AND WHEN
REQUIRED. EG. SEABIRD CUNY INVENTORY AND SOME
TOXIC CHEMICALS WORK. Most work is done
UNDER THE UMBRELLA OF PROTECTION OF MIGRATORY
BIRDS.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

I'm sure that DFO AND EP ARE DOING RELEVANT
PROJECTS BUT ASSUME YOU WOULD BE WRITING TO
THESE ALREADY. Much of the DFO CATCH
AND ^{Resource} DISTRIBUTION DATA COULD BE RELEVANT
EG. HERRING SPAWN.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Seabird Colony Inventory

Project objective(s)

Determine abundance and distribution of seabirds on the coast of B.C.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Pacific Coast.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

waterfowl breeding pair survey

Project objective(s)

population monitoring by
 annual counts of birds attempting to
 breed. Harvest is measured by National
 Harvest survey + indirectly by banding. Habitat
 quality measured by subjective survey + photo
 records.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

BC + Yukon; most intensive work currently
 in interior parklands of BC

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Dioxins in great blue herons, cormorants & diving ducks in the Strait of Georgia, B.C.

Project objective(s): To survey and monitor dioxin contamination in great blue herons, cormorants and diving ducks in the Strait of Georgia, and to determine if and how they might be impacted.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

Strait of Georgia

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Monitor the impact of agricultural pesticides on birds

Project objective(s): To maintain an account of all incidents of bird kills caused by agricultural pesticides in the region.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 - ☒ 8. contaminant levels in food; or
 - ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Monitor organochlorine and heavy metals in waterfowl hunted in the region

Project objective(s): To monitor hunted waterfowl for organochlorines and heavy metals, to safeguard the health of persons that consume the birds.

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Survey of ingested lead shot in hunted waterfowl in British Columbia and Yukon

Project objective(s): To determine the incidence of ingested lead shot in hunted waterfowl in the region. The information will be used to guide implementation of steel shot only regulations.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 - ⑨ exposure of fish and wildlife to toxic chemicals.

Name of Project: West coast seabird monitoring program

Project objective(s): To monitor representative seabird species on the west coast for organochlorine and heavy metal contamination. This is part of a national program.

Geographic scope (circle one): global
national
⑨ regional
local

If regional or local, what is the geographic area covered?



Environment
Canada

Environnement
Canada

Conservation and
Protection

Conservation et
Protection

2nd Floor, 4999 - 98 Ave.
Edmonton, Alberta
T6B 2X3

Your file - votre référence

Our file - notre référence

1465-1

November 15, 1989

Gregg Sheehy B.E.S., M.Sc.F.
Environmental Consultant
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Gregg:

In response to your request to Dr. Scotter, I am enclosing a package of questionnaires completed by members within the Wildlife Conservation Division.

Yours sincerely

Dr. R. Edwards
Head, Threatened Species Conservation
Canadian Wildlife Service
Western & Northern Region
Edmonton, Alberta

Canada

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. Ian Stirling . Telephone: 403-468-8914

Title: Wildlife Conservation and Research Division

Address: Canadian Wildlife Service, No. 210-4999, 98th Ave.

Edmonton, Alberta T6B 2X3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

See project 250 (next page)

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Polar Bear Ecology

Project objective(s)

relative to environmental indicators, the objectives are to monitor reproductive rates and condition of polar bears in two populations (Beaufort Sea and western Hudson Bay) in relation to environmental changes, both natural and unnatural. Fat specimens are collected for Dr. Ross Norstrom for toxic chemical monitoring. A principal objective is to measure the amount of natural variability that exists in the ecosystem in order to better be able to evaluate possible changes as a result of man-made perturbations.

Geographic scope (circle one)

global	x
national	x
regional	x
local	x

If regional or local, what is the geographic area covered?

eastern Beaufort Sea and western Hudson Bay

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: D. C. Thomas

Telephone: 435-7351

Title: Research Scientist

Address: 4999-98 Avenue, 2nd Floor
Edmonton T6B 2X3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Purpose: to investigate effect of forest fires on the
winter range of the Beverly herd of caribou.
Program: Wildlife Conservation and Endangered
Species Program.

Mandate: Herd was considered to be declining in
1980. Cooperative research under Caribou
Management Board.

Use: Results will contribute to fire management
program of NWT Dept Renewable Resources.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

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INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Effects of forest fires on the winter range of the Beverly herd of barren-ground caribou.

Project objective(s)

- 1) Determine if winter range adequate in quantity and quality for present herd size
- 2) Determine effects of burns on the distribution and movements of the herd
- 3) Determine recovery time of caribou forages after fire
- 4) Recommend if, when, and where fire should be controlled on the winter range of the herd.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Forested areas from Yellowknife region to northwestern Manitoba to depth of 100-200 km from the

limit of trees. Results applicable to taiga region of Canada.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: FRANK L. MILLER

Telephone: (403) 468-8927

Title: Research Scientist

Address: Conservation & Protection, Canadian Wildlife Service,
Western & Northern Region, 2nd Floor, 4999 - 98 Avenue,
Edmonton, Alberta, T6B 2X3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

To build a detailed data base on the ecological relationships of Peary caribou to their environment with emphases on (1) understanding how the physical elements of snow and ice influence numbers, distributions, and movements/migrations; (2) assessing any human-induced disturbance features that could impact detrimentally on the availability of "critical habitat"; and (3) being prepared to provide sound biological advice on the conservation and management of Peary caribou to other government agencies (federal and territorial) and to interested non-government organizations and concerned citizens.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

I assume that this form has been sent to all researchers within Environment Canada. Other logical possibilities would be researchers with (1) Oceans And Fisheries; (2) Geological Survey Of Canada, Energy, Mines And Resources Canada; and any university staff that is on federal government contracts for related research.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

PEARY CARIBOU CONSERVATION

Project objective(s)

The objective of this current research is to investigate ecological relationships of Peary caribou with physical conditions of their springtime environment that strongly influence forage availability to evaluate the importance of the occurrence of snow-free sites and intra-island redistributions or inter-island movements or migrations at that time of the year.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Canadian High Arctic, Northwest Territories, central Queen Elizabeth Islands, Bathurst Island complex

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. George Scotter Telephone: 403-468-8914
Title: Chief, Wildlife Conservation and Research Division
Address: Canadian Wildlife Service, No. 210-4999, 98th Ave.
Edmonton, Alberta T6B 2X3

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).
-

For projects 253-255 (see the following pages):

To conserve Canada's natural resources; protect Canada's environment
from deterioration; and manage ecological and economic interdependence.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.
-

3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

Dr. John Powell, Mr. Lorne Brace, Mr. Steve Zoltai and Mr. Brian Lee,
all at the Northern Forestry Research Centre, Forestry Canada, 5320-122
Street, Edmonton, Alberta, T6H 3S5

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Loggerhead Shrike Conservation

Project objective(s): This project is providing data on the basic biology, behavior and ecology of the loggerhead shrike in line with the requirements of the draft Recovery Plan for this threatened species, and coordinates studies of its distribution, abundance and ecology in the prairie provinces.

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Prairie provinces (but also wintering area of the species in southern U.S.)

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Integration of Migratory Bird and Timber Management

Project objective(s): To evaluate the impact of forest management techniques on migratory birds

Geographic scope (circle one): global
national
③ regional
local

If regional or local, what is the geographic area covered?

Northern prairie provinces, especially northern Alberta

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Remote Sensing Studies

Project objective(s): To develop techniques for use of remote sensing technology in the study of migratory bird habitat

Geographic scope (circle one): global
national
① regional
local

If regional or local, what is the geographic area covered?

Prairie provinces and Northwest Territories

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. Glen D. Adams

Telephone: 306-975-4093

Title: Research Scientist

Address: Canadian Wildlife Service
115 Perimeter Road
Saskatoon, Saskatchewan S7N 0X4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Research contributes to the mission of conserving and protecting

Canadian environments from degradation by providing recommendations

to public and private land managers to ensure that migratory bird

populations are sustained. The studies monitor impacts of public

and private land use activities and determine effectiveness of land

management or enhancement programs in securing quality waterfowl

nesting habitat and in contributing to waterfowl recruitment.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Prairie Pothole Project - Redvers Habitat

Evaluation

Project objective(s)

(1) To estimate the distribution and amount and to document changes in waterfowl habitat components as influenced by climatic changes and land use impacts in the rural municipality of Antler, Saskatchewan. (2) To evaluate the impact of habitat rehabilitation measures upon habitat changes.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

The municipalities of Antler, Maryfield and Walpole (430 mi.²)

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ 4. quantity and distribution of renewable resource stocks;
- ⑤ 5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Waterfowl recruitment on converted rangelands in the transition forest.

Project objective(s)

To evaluate waterfowl population densities, nesting success and recruitment on Prairie Farm Rehabilitation Administration (P.F.R.A.) rangeland plots affected by brush removal treatments.

Geographic scope (circle one)

global
national
regional
① local

If regional or local, what is the geographic area covered?

The area involves one P.F.R.A. pasture approximately 58 mi.² in area.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: George S. Hochbaum

Telephone: 204-983-5247

Title: Population Regulation Biologist

Address: 501 University Crescent, Winnipeg, Manitoba R3T 2E2

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Studies are designed to improve estimates of and quantity of waterfowl production and to assess factors related to waterfowl mortality so that long-term sustained use may be made.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

F. Dale Caswell

R.K. Brace

G. Trottier

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Lead Shot Study

Project objective(s)

Determine patterns of waterfowl ingestion of

lead shot and recommend alternatives.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
- ⑤ size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
3. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Population Mortality Program

Project objective(s)

Determine factors associated with waterfowl mortality (especially harvest and production related) and recommend acceptable alternates.

Geographic scope (circle one)

global

national

③ regional

local

If regional or local, what is the geographic area covered?

Western and Northern Region

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Central Arctic Goose Survival (Proposed)

Project objective(s)

-Estimate annual survival and harvest rate of Lesser Snow and Ross' Geese produced in the central Canadian Arctic.
-Determine factors which influence within-year survival probability in these populations.

Geographic scope (circle one)

global
national > Continental
regional
local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: H. Loney Dickson Telephone: 403-468-8917
Title: Wildlife Biologist-Shorebirds
Address: Canadian Wildlife Service--Western and Northern Region, Room
210, 4999-98 Ave., Edmonton, Alberta, T6B 2X3

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).

NWT Prairie Shorebird Program: to identify staging sites throughout
prairie Canada and eventually major nesting areas in the NWT; to
determine species population numbers migrating through prairie Canada
(also identify wintering and summer grounds of prairie migrants); food
studies/habitat requirements of migrants. Use of data includes
management plans to protect/enhance shorebird staging
areas.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?

Guy Morrison, CWS, Ottawa, Peter Hicklin, CWS Atlantic, Rob Butler,
CWS, Pacific and Yukon, E. Bourget, CWS, Quebec (all for
shorebirds)

All duck population biologists across Canada, e.g. Bruce Turner.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
- ⑧ contaminant levels in food; or
- ⑨ exposure of fish and wildlife to toxic chemicals.

Name of Project: Prairie/NWT Shorebird Program

Project objective(s): To identify species population sizes of shorebirds in prairie Canada; identify major staging areas in prairie Canada, and protect those sites and related wintering and nesting sites in the western hemisphere; define staging habitat requirements to enable management of wetlands.

Geographic scope (circle one): global
① (inter)national
regional
local

Concentrates on prairie Canada, but cooperative aspects and the Western Hemisphere Shorebird Network broaden the project to the western hemisphere.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: *CARBYN, L. N.* Telephone: *403-435-7357.*
Title: *Research Scientist*
Address: *Canadian Wildlife Service*
4999-98 Ave
Edmonton, Alta. T6B 2X3.

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

(See attached)

Recreational monitoring is carried out under the Man and Biosphere program. The program promotes greater understanding of sustainable resource use and management of resources. Research is conducted in Riding Mountain National Park, a Core Nature Reserve protected within an International Biosphere Reserve.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

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INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Large mammal systems studies
in Riding Mountain National Park.

Project objective(s)

To monitor long term
changes in wolf / prey populations
within Riding Mountain National
Park and assess the impacts of man
in areas adjacent to the park.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

ENVIRONMENT CANADA:
ENVIRONMENTAL PROTECTION DIRECTORATE

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Wayne Bissett

Telephone: 819-953-9257

Title: Chief, Chemical Industries Div.

Address: Industrial Programs Br., Environment Canada, Ottawa, K1A 0H3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The work is not considered research per se, but we do conduct surveys of plant (industrial facility) emissions, e.g., we are looking at VOC releases in the chemical industry.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Frank Vena

Wayne Draper*

Leo Buffa*

Dave Haliburton*

John Myslicki*

*All in Industrial Programs Br., DOE

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ①. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: VOC Inventory from Chemical Plants

Project objective(s): To determine release levels and examine appropriate control technology

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ☒ 1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

State Water and Environmental Institute
University of Illinois at Urbana-Champaign

Project objective(s)

Develop a water quality index

Geographic scope (circle one)

global
national
 regional
 local

If regional or local, what is the geographic area covered?

**STATUS REPORT ON COMPLIANCE WITH THE CHLOR-ALKALI MERCURY
REGULATIONS 1984-85**

by

I. McBeath
Chemical Industries Division
Environmental Protection
Conservation and Protection
Environment Canada

Report EPS 1/CI/1
April 1987

ABSTRACT

This report reviews the results of the measures taken by industry and government agencies to curtail mercury losses in liquid effluents, in products, in impounded solids and in air emissions from mercury cell chlor-alkali plants in Canada.

Mercury losses in liquid effluents during 1984 and 1985 averaged 131 kg per year, an increase of over 30 kg per year over the previous two years. This substantial increase is mainly due to changes in reporting procedures. The Stanchem plant previously reported only mercury discharges in process wastewaters, whereas the 1984-85 figure now includes mercury discharges to the sanitary sewer and two storm sewers, as well as the process effluent. As this plant has spent \$4.8 million to upgrade its wastewater treatment system, conditions will improve in the future.

Mercury emissions to air from cellrooms, cell end-box ventilation, hydrogen stream and retort, and other miscellaneous emissions, are presently around 900 kg per year, a reduction of over 96 percent since 1970. This substantial reduction is largely due to the conversion to non-mercury processes or closure of ten plants, and the installation of control equipment at the five remaining plants. Mercury emissions with the hydrogen and end-box streams is normally very low. Mercury emissions from the cell area at three plants, however, are still high and require more intensive cleanup and maintenance programs to reduce air emissions.

Mercury in products and impounded solids have been reduced by improved recovery methods.

The levels of mercury in fish taken from waters near most existing chlor-alkali wastewater outfalls (and from areas where chlor-alkali plants were previously located) have shown a dramatic decrease due to the significant reduction in mercury discharges. Mercury concentrations in fish taken from Lac St. Louis, Quebec, have not decreased significantly, mainly because of the continued input of high levels of mercury from the Stanchem plant and the very low rate of sedimentation in this lake.

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INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

STATUS REPORT ON THE VINYL CHLORIDE
INDUSTRY

Project objective(s)

SEE ATTACHED

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

**ENVIRONMENTAL STATUS REPORT
1979-1984
VINYL CHLORIDE INDUSTRY**

by

**Raouf Morcos
Chemical Industries Division
Industrial Programs Branch
Conservation and Protection
Environment Canada**

**Report EPS 1/AP/1
September 1986**

ABSTRACT

This report reviews the results of measures taken by industry to reduce vinyl chloride emissions to the atmosphere and describes other environmental protection practices relating to effluent discharges and hazardous wastes handling.

This is the first national status report that reviews compliance of the vinyl chloride and polyvinyl chloride (VC/PVC) industry with the federal Vinyl Chloride National Emission Standards Regulations which became effective on July 1, 1979. Provincial legislation specifically limiting the emissions of vinyl chloride is in place in Québec and Alberta. Ontario, the only other province in which this industry is located, does not have legislation specific to this industrial sector, but by agreement enforces the federal regulations.

The production capacity of this industrial sector has been increased by a factor of three since 1973. In the meantime, the emissions are estimated to have been reduced by 95% on a weight per weight of product basis.

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INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

ENVIRONMENTAL ASSESSMENT
OF THE CANADIAN TEXTILE INDUSTRY

Project objective(s)

See abstract attached

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

ENVIRONMENTAL ASSESSMENT OF THE CANADIAN TEXTILE INDUSTRY

**E.C. Chen
Chemical Industries Division
Industrial Programs Branch**

**Report EPS 5/TX/1
June 1989**

ABSTRACT

The purpose of this report is to assess the environmental problems associated with discharges from Canadian textile mills based on information obtained from surveys carried out in 1973/74, 1981/82 and 1985/86, respectively.

About 55% of the textile mills are located in Quebec and 40% in Ontario. Approximately 20% of the mills use wet processing and about half of these wet textile mills belong to the woven fabric and knit fabric dyeing and finishing subcategories. More than 80% of the wet processing mills discharge their effluents to a municipal system; about half of those discharging directly to a natural watercourse have wastewater treatment facilities.

All mills included in the surveys and discharging to a municipal system met the BOD and TSS limits set by local municipal sewer by-laws. Mills with secondary wastewater treatment had loadings of BOD and TSS within or close to the U.S. EPA BPT limits as well as Environment Canada's 1978 Proposed Guidelines. Most of the mills had an effluent pH value within the range of 6 to 9.

Metal pollutants expected to be found in textile mill effluents are zinc, copper, chromium, lead and nickel; the effluent concentration of these metals individually are all less than 1 mg/L, the discharge limit set by most of the local municipal sewer by-laws. Possible organic priority pollutants in textile mill effluents, at the ppb levels, are substituted benzenes, naphthalene, phenol, substituted phenols, chloroethylenes, chloroethanes and phthalates.

Effluents from mills without wastewater treatment or with only primary treatment would be coloured and toxic to fish. However, mills with a well-operated biological treatment system can produce an effluent non-lethal to fish and with no apparent colour. A well-operated biological treatment system can also reduce the effluent surfactant concentration to an insignificant level.

Wastes other than wastewaters and sludges produced by textile mills include waste fabric, waste fibres, waste oils and latex wastes; the latter two types of wastes are considered to be hazardous.

Most of the textile mills surveyed have some controls of the particulate/fibre and dust emissions. However, very few have installed control devices for solvent vapours, oil mists and odour.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. L. Buffa

Telephone: 819-953-1103

Title: Chief, Mining, Mineral and Metallurgical Processes Div.

Address: Industrial Programs Br., Environment Canada, Ottawa, K1A 0H3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Analysis of releases and ways of removing them from effluents: who's releasing what; how much is being released.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project IDENTIFICATION OF METALS RELEASED
BY 13 LATOR METALLURGICAL OPERATIONS -

Project objective(s) MEASUREMENT / ESTIMATE OF
RELEASES OF Cd, As, Ni, Pb, Hg AND Cr
TO ATMOSPHERE, WATER AND LAND -

Geographic scope (circle one)

global
national
regional

local

13 LOCATIONS

If regional or local, what is the geographic area covered?

MOST PROVINCES -

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: D.W. Draper

Telephone: (819) 953-1120

Title: Chief, Oil, Gas & Energy Division

Address: Industrial Programs Branch ;

Environment Canada,

Ottawa, Ontario, K1A 0H3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

To assess the effectiveness, costs and applicability of technologies to control emissions of SO₂, NO_x and CO₂. Information is applied primarily to national programs on NO_x/VOC's, ACID RAIN, and CLIMATE CHANGE.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

I. Dano, Environment Canada, River Road Environmental Technology Centre.
- Ambient Air Quality/NAPPS Network

F. Vena, Environment Canada, M.E.B.

- Emission trends for NO_x, VOC, SO₂ and others.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Control options for SO₂ - Major Fossil Fuel Combustion Sources.

Project objective(s) To assess the effectiveness, costs and applicability of technologies to control SO₂ emissions from major fossil fuel combustion sources, and to estimate potential impacts of technologies on total national emissions.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ☒ 1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Control options for CO₂ - Major Fossil Fuel Combustion Sources.

Project objective(s)

To assess the costs, effectiveness and applicability of technologies to control CO₂ emissions from major fossil fuel combustion sources, and to estimate potential impacts of technologies on total national emissions.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Control options for NOx/VOC

Project objective(s)

To assess the effectiveness, costs and applicability of technologies to control NOx/VOC emissions from major stationary sources, and to estimate potential impacts of technologies on total national emissions

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: William Ernst Telephone: 902-426-6141
Title: Head, Pesticides and Ecological Effects Section
Address: Environmental Protection, Environment Canada, 15th Floor,
Queen Sq., 45 Alderney Dr., Dartmouth, N.S., B2Y 2N6

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).

Measure impacts of pesticides/toxic chemicals

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.

- 3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?

Mr. D. Busby, CWS, Sackville, N.B.

Dr. T. Pollock, IWD, Moncton, N.B.

A COMPARISON OF THE AQUATIC TOXICITY OF FENITROTHION FLOWABLE AND FENITROTHION EMULSION FORMULATIONS

(W.R. ERNST AND K. DOE)

Introduction

Fenitrothion has been the chemical of choice for the control of the spruce budworm (Choristoneura fumiferana) in Canada for the past two decades. The operational spray programs have employed emulsion formulations containing liquid technical fenitrothion. A recent development is the production of a "flowable" formulation which consists of finely milled particles of the active ingredient in suspension. The presence of the pesticide in a particle form has the potential to alter its bioavailability.

Methodology

A series of acute tests (48 and 96 h LC50s) was undertaken to compare the aquatic toxicity of conventional (liquid technical) fenitrothion emulsions with that of the "flowable" (particulate) formulation. The species tested were: rainbow trout (Oncorhynchus mykiss); threespine stickleback (Gasterosteus aculeatus); freshwater clams (Anodonta spp.); blue mussels (Mytilus edulis) and the water flea (Daphnia magna). Uptake comparisons were made with those two formulations using blue mussels.

Results and Discussion

In acute toxicity tests, for most species, the toxicity of liquid technical formulation was not substantially different from that of the particulate formulation. The exception was that the particulate formulation was less toxic than the liquid technical formulation to the freshwater clam by a factor of 1/3 to 1/5.

Bioconcentration factors to blue mussels for the flowable formulation (15 to 36) were approximately 1/8 to 1/2 the blue mussel bioconcentration factors previously reported for the liquid technical formulations. The results indicate that the flowable formulation does not represent an increased hazard to the aquatic organisms tested, compared with the conventional liquid technical formulations.

For further information contact:

W.R. Ernst
Environmental Protection Service
Conservation & Protection
Environment Canada
15th Floor, Queen Square
45 Alderney Drive
Dartmouth, N.S.
B2Y 2N6.

(902) 426-6141

OFF-TARGET DEPOSIT OF AGRICULTURAL INSECTICIDE SPRAY APPLIED BY
AIRCRAFT AND THE ASSOCIATED IMPACT ON AQUATIC FAUNA
(W.R. ERNST, P. JONAH, K. DOE, G. JULIEN AND P. HENNIGAR)

Introduction

Aerial drift from pesticide spray applications can result in contamination of non-target environments, particularly aquatic systems. One method of attempting to prevent that unwanted deposit is to implement buffer zones, where pesticides may not be directly sprayed, around sensitive aquatic areas. The width of such buffer zones is dependent upon the kinetics of off-target deposit and the toxicity of the pesticide to exposed fauna. This study measured the off-target deposit and the associated aquatic impacts, on several species of aquatic fauna, of an agricultural pesticide spray applied by aircraft in order to determine the size of buffer zones necessary to protect aquatic systems.

Methodology

Deposit of aerially applied endosulfan was collected on flat plate samplers and in containers of water placed at various distances downwind of the treated area. The water contaminated by that deposit was subsequently used to conduct 24 h lethal bioassays in a nearby temporary laboratory, using threespine stickleback (*Gasterosteus aculeatus*), water boatmen (*Sigara alternata*), caddisfly larvae (*Limnephilus* spp.), bivalve molluscs (*Pisidium* spp.), bloodworms (*Chironomidae* spp.) and water fleas (*Daphnia magna*). Three different spray events were sampled, all of which occurred at times when meteorological conditions were within regulatory constraints.

Results and Discussion

Chemical analysis of deposit collectors and exposed water indicated that deposit decreased in an exponential manner with distance downwind and ranged from 82 mg/m³ and 1.7 mg/L for plates and waters within the target site to 0.051 mg/m³ and 0.004 mg/L for plates and waters at 200 m downwind. After 24 h exposure to spray drift contaminated water, no mortalities which could be attributed to the pesticide were observed for bivalve molluscs, bloodworms or water fleas, even within the treated area. Water boatmen, caddisfly larvae and threespine stickleback, on the other hand, suffered levels of mortality which varied directly with distance downwind from the treated area. The distances at which 50% mortality was measured in water boatmen and caddisfly larvae tests were 50 m and 10 m respectively. Threespine stickleback were the most sensitive species tested and they had mortality rates of up to 90% at a distance of 200 m downwind. These results demonstrate the extreme hazard to aquatic organisms from drift deposit of aerially applied endosulfan and indicate the need for similar assessments of other popular pesticides.

INCIDENCE AND MAGNITUDE OF FOREST POND

CONTAMINATION BY FENITROTHION

(W. ERNST, G. JULIEN, P. HENNIGAR)

Introduction

Fenitrothion has been the chemical of choice in spray programs against forest defoliators in the Atlantic Region for over twenty years. Contamination of watercourses by fenitrothion is an unavoidable aspect of such spraying. A recent review, conducted by C&P/AR has indicated that although most watercourse contamination does not cause large impacts, there are certain watercourses which are theoretically at high hazard. These are small, still water bodies, such as forest ponds. Studies have indicated that at simulated operational dosage rates, aquatic invertebrate impacts in small bog ponds are of such magnitude as to alter energy flows and threaten ecological integrity. Those water bodies are among the most difficult to detect from the air and therefore protect with buffer zones. The exposure to fenitrothion that small ponds receive during operational spray programs had not been measured and therefore the risk could not be assessed.

Methodology

Ten ponds within operational forest spray blocks were selected for observation. Immediately before spray, flat plate deposit samplers were evenly distributed over the surface of each pond. Within a short time after spraying (15 minutes) residues on deposit samplers were collected along with a similar number of surface water (top 1 cm) samples from the pond and its outflow. The fenitrothion content of conifer vegetation adjacent to the ponds was also determined before and after spray.

Results and Discussion

Ground observations at the time of spraying indicated that none of the ponds were subject to set-backs and therefore received direct application. Problems in flight line alignment resulting in "shipped" lines or "double swathing" were noted in three of the ten applications. Fenitrothion content of sprayed vegetation indicated deposits that were very comparable to those observed previously after similar spray programs. Mean concentrations in surface water from individual ponds ranged from 0.02 mg/L to 1.5 mg/L. These values are much higher (up 100 times) than the mean maximum concentrations previously observed in lentic systems and within the range of concentrations known to be acutely toxic to endemic fish and invertebrate species. The need to protect such water bodies from direct application of fenitrothion was established.

DISPERSION OF DICHLORVOS FROM A SIMULATED
SALMON ECTOPARASITE CONTROL PROJECT
(W. ERNST, G. JULIEN)

Introduction

Dichlorvos is an acaricide which has been used in the Atlantic Region to control ectoparasites in finfish aquaculture. It is a pesticide which is extremely toxic to aquatic organisms with acute (96h LC50) lethal effects to lobster larvae occurring at approximately 6 ug/L. Zooplankton mortality has occurred at concentrations as low as 1 ug/L and primary productivity has been measurably reduced to concentrations of 14ug/L. The use pattern in aquaculture can be classed as "open", resulting in the release to marine environments of all the pesticide solutions used for treatment. Since the fate of the pesticide after such use is largely unknown, a study was undertaken to measure the dispersion characteristics in a marine situation.

Methodology

The circulation patterns of a small coastal inlet were determined by means of: dye and drogue tracking, as well as measurement of currents, salinity and temperature with depth. Dichlorvos was subsequently released at concentrations and depths to mimic treatment of a large number (50-80) of salmon pens. Based on dispersion predictions from the circulation characteristics, grab samples at several depths were obtained at various times after release and at various distances from the release point. Those samples were analyzed for dichlorvos content.

Results and Discussion

The highest concentrations of dichlorvos (32 μ g/L) were measured (32ug/L) at the release site within 15 minutes of release. At 90 and 100 minutes post-release the highest concentrations were 5.7 and 2.4 ug/L respectively. By 300 minutes post-release, the highest measured concentrations were near the detectable limit of 0.1 ug/L. The chemical plume was observed to spread over a broad area (approx. 1km) and to penetrate a moderate thermocline to a depth of 5.5m. The measured concentrations are within the range known to be toxic to planktonic organisms and the environmental implications of such use could be severe.

For further information contact:

W.R. Ernst
Environmental Protection Service
Conservation & Protection
Environment Canada
15th Floor, Queen Square
45 Alderney Drive
Dartmouth, N.S.
B2Y 2N6.

(902) 426-6141

DEVELOPMENT OF REFERENCE SPRAY BUFFER ZONES
TO PROTECT SENSITIVE NON-TARGET AREAS
(C.J. WIESNER, L.V. PARSLow AND W. ERNST)

Introduction

The protection of sensitive non-target areas by establishing no-spray buffer zones has been a principle of pesticide application regulations in many jurisdictions. Unfortunately, in most instances the size of buffer zones required for specific types of applications has very seldom been based on empirical evidence but rather a "best guess" estimation.

The recent development of computerized models of off-target transport and deposition of aerial pesticide sprays has the potential to provide a systematic, scientifically sound regulatory tool for the setting of protective "buffer zones" around sprayed areas. Under contract, a wide range of both agricultural and forestry aerial application scenarios using two models developed in the United States - AGDISP Mod. 4 and FSCBG.

Methodology

One hundred and fourteen scenarios were modelled by varying aircraft type, spray height, atomizers, spray spectrum, wind speed, temperature, humidity and atmospheric stability. The program input parameters required by the models were obtained from aircraft manufacturers, scientific publications and spray operators..

The models then predicted levels of downwind, off-target spray deposition for each scenario. The "worst-case" scenario was identified from each set and a "buffer zone" calculation was made for several representative pesticides using published toxicity data.

Results and Discussion

These calculations led to a prediction of the downwind distance or "buffer zone" needed to achieve a "no observable effect level" of exposure to sensitive aquatic species under the "worst case" scenario.

This exercise demonstrated the potential of modelling drift for regulatory purposes although considerable problems and ambiguities were encountered particularly in the process of input parameter selection.

For further information contact:

W.R. Ernst
Environmental Protection Service
Conservation & Protection
Environment Canada
15th Floor, Queen Square
45 Alderney Drive
Dartmouth, N.S.
B2Y 2N6.

For further information contact:

W.R. Ernst
Environmental Protection Service
Conservation & Protection
Environment Canada
15th Floor, Queen Square
45 Alderney Drive
Dartmouth, N.S.
B2Y 2N6.

(902) 426-5111

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Michael Guilcher

Telephone: 902-426-6135

Title: Chief, Industrial and Shellfish Programs Div.

Address: Environmental Protection, Environment Canada, Queen Sq., 45
Alderney Dr., Dartmouth, N.S., B2Y 2N6

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).

Environmental Control for Industries and Municipalities
Environmental Quality--Determination of
Environmmetal Protection--Shellfish

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ① production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Industrial/Municipal Pollution

Project objective(s): To determine and evaluate industrial and municipal pollution and to effect corrective action, if necessary

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

Atlantic Canada

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Shellfish Program

Project objective(s): Determine water quality and thus classify shellfish growing areas

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Atlantic Canada

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Lee Harding

Telephone: 604-566-2917

Title: Manager, Marine & Estuarine Programs

Address: Environment Canada, Kapilano 100 S. Park Royal, West
Vancouver, B.C. V7T 1A2

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).
-

Marine Pollution Prevention

- Environmental managers, policy makers and the public (informed
public/interest groups) need concise and easily understandable
information on marine environmental quality. These projects explore
methods of applying indices and managing and displaying resultant data
in perspective of (a) other regional data, and (b) relation to natural
background and adverse effects levels.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.
-

3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

Peter Wells, E.P., Halifax

Wayne Bouchard, E.P., Halifax

Ron Buchanan, B.C. Ministry of Environment, Victoria

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 - ☒ 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Contaminant Data Management/Display

Project objective(s): Determine efficient methods of managing georeferenced data management to produce (a) Regional summaries of contaminant levels in sediments and biota, (b) maps of sample stations and symbolic representation of contaminant levels and (c) graphs of contaminant levels that reference (i) baseline levels and (ii) effects threshold levels.

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

B.C. Coast

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Sediment Quality Triad

Project objective(s): Adapt Trial (developed in Puget Sound; also applied to San Francisco Bay) to assess significance of in situ sediment contamination in Vancouver Harbour.

Triad includes chemistry, toxicity and biological effects of contaminated sediments; an index is derived from test results.

Geographic scope (circle one): global
national
regional
☒ local

If regional or local, what is the geographic area covered?

Vancouver Harbour

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Vancouver Harbour

Project objective(s): Determine if fish tissue abnormalities can be used as an index to marine environmental quality

Geographic scope (circle one): global
national
regional
local (applied locally, but it's a technique which has been used in U.S.)

If regional or local, what is the geographic area covered?

Vancouver Harbour--technique will apply to other locales in Region and other regions of Canada

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: **E. F. MULLER** Telephone: **953-1138**
Title: **Industrial Programs Br. EP, DOE, Ottawa**
Address: **7VM-13th Fl.**

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

1. Control of dioxins/furans in effluents from pulp and paper mills using chlorine bleach processes
2. Control of releases of "conventional" * pollutants from pulp and paper mills in Canada
* Suspended solids, BOD, Toxicity

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Camille Maglass, DFO, 990-0303
Dr. R. Norstrom, CWS, 997-1411
Dr. J. Casey, NNRI, (416) 336-4693

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ☒ 1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

1987 Status of Emission Controls
of Pulp and Paper Mills

Project objective(s)

1. Determine total suspended solids, BOD
and Toxicity for all pulp mill effluents
in Canada
2. Relate releases to control requirements

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑤ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

National Sampling Program
for Dioxins/Furans in Sediments and Fish

Project objective(s)

Management of DOE's
Component

(see att.)

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

~~As you may know~~ The federal government has accorded a top priority to the investigation of dioxin/furan contamination of fisheries resources. In 1988 it established a two-year national sampling program to determine the scope and extent of dioxin/furan contamination in sediments and fisheries resources in the vicinity of bleached kraft pulp mills and to take the appropriate actions where public health was deemed to be at risk.

Environment Canada's focus has been on the sediment part of this program, Fisheries and Oceans focused on the fishery resources, and Health and Welfare provided the health evaluation of the analytical results. The prompt actions taken by the federal government to protect the Canadian consumers from dioxin/furan contaminated fishery products have been based on this program and particularly on the health advice provided.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Frank J. Ivo Telephone: 952-1111
Title: Chief, Inventory Management Division
Address: Place Vincent Massey.

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

1) Reduction of wastes, effluents from industry, transportation and other activities
2) Levels of contaminants in air, water, soil

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Don Williams - Pollution Measurement
Division, River Road Technology
Center

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- (1) production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

National inventory of FCO_2

Project objective(s)

To establish the sources and quantities of the emissions of FCO_2 to support the analysis/establishment of control options; & other reduction options

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ① production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Treasury of common pollutants

Project objective(s)

To track the emissions of
SO₂, NO_x, VOC's, CO, particulates in
support of a) LRTA program
b) CAFE NO_x/VOC issue
and to assess the effectiveness of
control programs.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Analysis of Urban Air
Quality Trends

Project objective(s)

To assess the changes in
urban air quality in Canada and
national objectives and to analyze the
trends

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Environmental Protection
15th Floor, Queen Square
45 Alderney Drive
Dartmouth, Nova Scotia
B2Y 2N6

15 December 1989

Mr. Gregg Sheehy
Environmental Consultant
7011 Bilberry Drive
Oleons, Ontario
K1C 2C2

Dear Mr. Sheehy:

RE: SOE INDICATOR SURVEY

First, I must apologize for the tardiness of my response, however, it seems your survey has reached my desk by the scenic route. I trust the information attached remains timely. On that note, I suspect if our experience is any indication, a considerable number of potential indexes have been missed.

Attached please find the completed questionnaires. Should you have any questions, please contact the person noted.

Yours sincerely,



W. Wayne Barchard
Head, Marine Assessments Section
Marine Environment Branch

WWB/pen

cc: A. McIver
R. Percy
D. Aggett
T. McRae/SOE/HQ



FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Wayne Bouchard Telephone: 902-426-8304
 Title: Head, Marine Assessment Section, CIP Atlantic
 Address: 45 Alderney Dr. Dartmouth, NS.

B2Y 2N6

902-426-8304

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

- Marine Status and Trends / M&T Monitoring
 - Environmental Effects Monitoring related to Audubon, CEPA (P&VI)
 - Environmental Emergency response effectiveness.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Richard Toblin, DFO at BIO

Don Gordon " "

Jack Uthe " "

Michael Bowers " "

Robert Wells, M&T advisor, CIP (Atlantic)

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ① production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Spill Trends Data Base

Project objective(s)

- Record data relating to spills of oil and hazardous chemicals
- Data for period 1974 to 1989 is on file
- Data includes date, location, product spilled, cause, receiving agency

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

ATLANTIC PROVINCES

Contact: *S. Lewis 426-6318*

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Bill Moores

Telephone: (902) 426-2004

Title: Head, Chemical Processes Section

Address: 4th Floor, Queen Square
45 Alderney Drive
Dartmouth, N.S.
B2Y 2N6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?):

- indicate compliance with regulations under CEPA and the Fisheries Act. Determine appropriate enforcement response.
- measure air quality in larger urban ^{cities} areas in Atlantic Region (NAPS)
- measure ozone levels in urban and rural areas in Atlantic Region
- measure levels of lead in gasoline sold in this Region

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ① production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Source Regulations - Toxic Substances

Project objective(s)

To ensure compliance with CEPA
and Fisheries Act Regulations

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

New Brunswick, Nova Scotia, Prince Edward Island

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Fuels Regulations

Project objective(s)

to ensure compliance at the refining and retail levels with the CEPA leaded and Lead-Free Gasoline Regulations

Geographic scope (circle one)

global

national

☒ regional

local

If regional or local, what is the geographic area covered?

NS, NB, PEI

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

LRTAP Monitoring - Oxidants

Project objective(s)

To estimate the impact of ozone
in the region from local and long range
emission sources to assist in the development
of oxidant control strategies.

Geographic scope (circle one)

global
 national
regional
 local

If regional or local, what is the geographic area covered?

NB, NS, NAd, PEI

Environment
Canada

Environnement
Canada

Conservation and
Protection

Conservation et
Protection

Subject: Contaminants

Subject: Contaminants

Conservation and Protection
Ontario Region
Ottawa District Office
2100 River Road
Ottawa, Ontario
K1A 0H3

4262-J6-5-6-1

November 29, 1989

Mr. T. Sheehy
Environmental Consultant
7011 Bilberry Dr.
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

Re : YOUR LETTER TO K. SHIKAZE DATED OCTOBER 5, 1989

In response to your letter and questionnaires, please find enclosed a completed questionnaire on the Cornwall Island fluoride monitoring program. This project falls under category 6 "levels of contaminants in air, water or land". If you require any further information on this project, please feel free to contact me (352-8679).

Yours truly,



Lawrence King
Project Officer
Environmental Protection

c.c. D. Cameron
K. Shikaze

Canada

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Lawrence King Telephone: (613) 952-8679
Title: Project Officer
Address: Environment Canada, Conservation & Protection
Ontario Region, Ottawa District Office
49 Camelot Drive, Nepean, Ontario, K1A 0H3

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Monitoring only

Only one project under this office.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- X 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Cornwall Island Fluoride Monitoring.

Project objective(s) Provides a long term seasonal database--
((April to October) for fluoride (gaseous and particulate) levels
on Cornwall Island which is part of the Mohawks of Akwesasne
Indian Nation. This island is affected by fluoride emissions
from Reynolds Aluminum south of the island in Massena, New York.
The data will be used for further negotiations between the Mohawk
Nation and Reynolds Aluminum.

Geographic scope (circle one) global
 national
 regional
 X local

If regional or local, what is the geographic area covered?
Cornwall Island, Cornwall, Ontario.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK
SURVEY QUESTIONS

Your Name: T. Dann

Telephone: 613-991-9459

Title: Head, Air Toxics

Address: River Road Environmental Technology Centre,
Environment Canada, Ottawa K1A 0H3

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).
-

See next page.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.
-

3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 - ☒ 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: National Air Pollution Surveillance

Project objective(s): Strategically located in approximately 50 urban regions across Canada--comprising about 70 per cent of the total Canadian population--the National Air Pollution Surveillance (NAPS) Network was established as a joint project of the federal and provincial governments. Its purpose: to monitor and assess the quality of ambient air in Canadian towns and cities.

Geographic scope (circle one): global
☒ national
regional
local

If regional or local, what is the geographic area covered?

ENVIRONMENT CANADA:
INLAND WATERS DIRECTORATE

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: ADRIAN DEMAYO Telephone: 997-1921
Title: CHIEF, WATER QUALITY ASSESSMENTS
Address: 7M - 7th FL.

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Develop a Water Quality Index (WQI)
to be used in:

• communicating the state of the quality
of rivers and lakes in Canada at given locations
in Canada.
• state of the environment reporting

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Kirk Hamilton + Bruce Mitchell -
Statistics Canada.

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Water Quality Index

Project objective(s)

To communicate:

- . Temporal and spatial changes in water qual.
- . water suitability for certain uses (first approximation)
- . awareness of a water quality issue (first approximation)

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

DEVELOPMENT OF WATER QUALITY INDICES

PROJECT SPECIFICATIONS

A. Background

In the early 1970's several papers have been published on the topic of water quality indices. Several different formulas have been proposed on how to group various water quality variable into a single number, a water quality index (WQI).

During the same period, in Environment Canada a working group proposed a WQI for use in Canada. The proposal did not gain acceptance within the department and eventually died. Some of the reasons for the lack of acceptance were:

- . The single formulation proposed was not deemed acceptable to the entire country.
- . The proposal did not take into account various water uses.
- . The proposal did not deal adequately with the toxic compounds. In fact, this was perhaps the major objection from the Environment Canada's scientists: reluctance to accept the aggregation of values which may "mask" the significance of some of the individual components of the index.

While in Canada the work on the development of water quality indices has practically stopped, in others countries, notably U.S., U.K. and Brazil, various formulations of WQIs were developed and then used to follow water quality trends, to report on the quality of the water resources and to manage these resources.

B. Current Interest

The rapid acceptance of the State of the Environment reporting in Environment Canada, the interest generated by it and elsewhere, and added new emphasis to the long-existing knowledge (but not acted upon) that there is a great need for more analysis and interpretation of the data collected by EC and other agencies, and for new tools to communicate the information generated, especially to the interested public.

Because of the large number of variables, some very complex chemicals, making up water quality the need for new assessment and communication tools in this field is acute. In trying to explain and illustrate the water quality at a given location and time, or its trend, would be very desirable to be able to aggregate a number of variables such that, on a first

"approximation", one will have to follow only a small number of "indicators" rather than a large number of variables. This approach, already used in a number of fields such as economics, (consumer price index) and environment (air quality index), has been well accepted not only by the general public and the media, but also by professionals in the respective field or other fields.

C. Objective

The objective of this project is to:

Develop a series of water quality indices that will serve as a communication tools. They will communicate to the general public:

1. Temporal and spatial changes in water quality
2. "A first approximation" to the suitability of water for a particular use, and
3. Seriousness, again on a "first approximation", of a water quality issue.

D. Methodology

The indices will be formed by aggregating a number of water quality variables. The aggregation should be scientifically sound, the reasons for choosing specific variables and aggregating them into an index must have a scientific basis. For example:

- . The variables are similar from a chemical point of view (e.g., heavy metals, chlorinated pesticides);
- . The mode of action on the environment is similar;
- . The research has shown that the environmental impact can be expressed by some combination of individual variables, and/or
- . The variables are use/or issue-related.

E. Work to be done

1. Select the water quality indices to be developed and the issues/uses which they will address.
2. Select water quality variables which will be included in each index.
3. Develop the appropriate aggregation functions including:

- . Transformation function to common scale for each variable
- . Variable weights, if they are necessary

The aggregation and transformation functions, and the variable weights must be obtained in a scientifically sound manner and be based on published data.

4. Test in relation to be objectives given in "C", the WQIs in two specific cases, the St. Lawrence River and Lake Ontario. The precise locations, a minimum of three in each of these two water bodies, and the period of time will be decided jointly by the contract officer and the contractor. The data for the test will be provided by Environment Canada.

5. Develop the appropriate microcomputer routines to calculate, tabulate and graph WQIs by location and/or period of time as bar graphs, XY or box plots.

6. Prepare written report describing:

- . Objectives of his study
- . Methodology used
- . Indices developed
- . Results of testing the indices
- . Recommendations for use of WQIs
- . Recommendations for future developments in this area.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: I. McLaurin Telephone: 819-997-1474
Title: A/Chief, Water Survey of Canada
Address: Water Resources Br., Inland Waters Directorate,
 Environment Canada, Ottawa K1A 0H3

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).
-

See next page.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.
-

3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Water Survey of Canada

Project objective(s): To manage federal-provincial and other agreements responsible for the collection and processing of more than 3,400 active streamflow, water level and sediment data gauging stations.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Paul H.

Telephone: 953-1547

Title: Senior Hydrologist, Water Resources Branch

Address: 8th Ave, PVM, Hull

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The Water Resources Branch collects basic water quantity and sediment data under the FRS National program on National/Regional Water and Wildlife Resources. WKB analyzed and interprets these data on an on-going basis, on both regional and national scales, to provide information on the quantity and distribution of surface water and sediments. The project described below is one which may lead to the development and use of specific indicators for water quantity.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

No.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- (4) quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food, or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

WMO Time Series Analysis of Long Term ^{Hydrometric} Stations

Project objective(s)

To analyze the variability of streamflow

data collected at some 100 hydrometric gauges across Canada. To assess the trends observed in the data.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Water Use in Canadian Industry, 1981

Donald M. Tate and David N. Scharf

1. INTRODUCTION

This paper describes and discusses the statistical results of an industrial water use survey for 1981. It represents an updating of two similar surveys for Canada, completed in 1972 and 1976 (Canada, 1977, 1983). Data collected during the survey have already been used in a variety of federal and provincial studies, and publication of this statistical summary represents the final stage of the survey process.

1.1 Scope of the Survey

The industrial water use survey, consisting of four sectors - manufacturing, mineral extraction, thermal power and hydro power - was undertaken under the Federal Statistics Act. Some assistance was provided by officers of the Manufacturing and Primary Industries Division, Statistics Canada, in selecting the mailing list for the survey. Environment Canada was responsible for all other tasks, such as survey design, editing, data processing and production of the final results. This national survey also benefited from the cooperation of the Planning Division, Alberta Environment, which performed its own survey and data tabulation within that Province, using the same questionnaire. The Alberta results have been incorporated into this publication. The Water Resources Branch of the Manitoba Department of Natural Resources also provided valuable assistance to the survey of industries in that province through its involvement in the follow-up phase.

1.1.1 *Outline of the Paper*

This paper concentrates on water use in the manufacturing sector. The major part of the discussion examines water use patterns by the various sectors of manufacturing and by province. The Appendices contain basic details on the mineral extraction sector (Appendix A), thermal power sector (Appendix B) and copies of the questionnaires (Appendix C). No data are presented on the hydro power sector, since the hydro questionnaire elicited data on power generation plus a series of technical questions about operating characteristics.

1.2 Survey Methods

1.2.1 *Respondent Selection*

The survey was based upon a universal mailing to selected categories of the manufacturing industry, the mineral extraction industry, the thermal power plants and hydroelectric power plants across the country. Although the mineral extraction and power sectors are not included in the discussion undertaken in this paper, basic water use data are presented in Appendices A and B.

Municipal Water Rates in Canada 1986 — Current Practices and Prices

1. INTRODUCTION

1.1 PURPOSE AND OVERVIEW

This report presents and analysis of municipal water rates and prices in Canada. More precisely, its purposes are to describe the types of water rate schedules in use, to compile both the unit prices (i.e., prices per cubic metre) and the total prices of water paid by consumers across Canada, and to evaluate current practices against some commonly accepted criteria for the operation of municipal water systems.¹

Following a brief outline of the methodology used in this project, Section 2 describes in detail the major characteristics of municipal water pricing as currently practiced. Emphasis is placed on (a) the types of overall rate schedules in use, (b) the price per cubic metre paid by customers, and (c) the total monthly price paid by customers for standard volumes of water. (Where billing occurs on a bi-monthly or quarterly basis, prices have been converted to equivalent monthly terms).

Throughout Canada, sewage treatment expenses are normally recovered through surcharges added to the water bill. The term "water pricing practices", as used in this paper, includes the sewage dimension. While the "unit water prices" outlined in the paper are for water supplies only, the monthly water prices include any applicable sewage surcharges. Section 3 assesses the water and sewage rate-making practices used in Canada against the criteria of revenue recovery, equity, efficiency and local acceptability.

1.2 METHODOLOGY

The study is based on a survey of water pricing practices in Canadian municipalities by the Inland Waters Directorate of Environment Canada. A request for copies of 1986 water (and sewage) rate schedules was sent to all municipalities with a population over 5000, plus a 10% sample of those between 1000 and 5000. The usable returns from this letter survey were

entered into a database designed to compile both unit water prices (i.e., price per cubic metre) and total water prices to residential and commercial customers for selected volumes of monthly water supply and sewage. Compilations of these unit and total prices form the basis for the discussion of Section 2. Finally, information on criteria for rate setting was derived, principally from the water rates manual of the American Water Works Association (AWWA, 1983). These criteria were used to assess current Canadian water pricing practices.

1.2.1 Surveying the municipalities

The water rate survey produced usable results for 470 of the 800 municipalities surveyed (Table 1). Of the remaining 330 municipalities, 150 did not respond, while an additional 180 had rate scheduled which could not be analyzed systematically because they were unique in some way with respect to their water pricing practices. For example, many of these municipalities based their water charges on assessed property value or frontage.

Since assessed value and frontage data were not collected, water prices for these municipalities could not be calculated, and they were omitted from further consideration. However, these municipalities were all quite small in population terms, permitting the survey to attain a fairly good coverage of Canada's total urban population. About 15.7 million persons, or 78% of Canada's total urban population in 1986 resided in the 470 municipalities considered in the analysis.

1.3 LIMITATIONS

There are several items related to water pricing which were considered to be beyond the scope of this study. First, the analysis is limited to a consideration of residential and commercial water users. Although municipal water rates may also pertain to industry and some rural users (e.g., those residing near but outside municipal boundaries), these users often impose special requirements not considered in this study. Second, the extent to which system costs and other factors influence the setting of water rates has not been examined in any depth. The implication of this point is that the rates collected for this report do not necessarily reflect the true cost of providing water services in many municipalities. Indeed, to the extent to which water rates are viewed as a method of revenue generation, they may include elements not related to water servicing. Third, several provinces charge licence fees for water abstrac-

¹ Throughout this paper, water rates refer to the schedules of charges set by municipalities as the basis for periodic water prices paid by customers for water services (including sewage). In all cases, water prices are converted to monthly amounts, and include combined water and sewerage payments. The subject of more general charges, normally by provinces, for abstraction of water from surface or ground-water sources is not included here.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: H. Vaughan

Telephone: 416 - 336-4915

Title: A/Dir. Rivers Research Branch

Address: NWRI, CCW

Box 5050

Burlington, Ont

L7R 4A6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Indicators are developed to generate information on a specific problem area (e.g. local LRAP effects, setting priorities for intervention by assessing relative toxicity, downstream effects of development, etc). Much of this may be relevant to the pursuit of general indicators as described. The attached sheets briefly describe what could be considered as indicators though it is not an exhaustive list. I have taken the liberty of listing the other Branches, but not Fisheries, Water Quality Branch, Water Planning and Management or Wastewater Technology Centre. For further information, I (cont'd)

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

(cont'd) Strongly recommend that you review the enclosed general description of research: "Research '88" (a new version is in press). The point is, all the researchers here work on 'indicators': it simply depends on how you define them. Please do not hesitate to call with questions.

H. Vaughan

19. X. 89

CURRENT RESEARCH '88

**A SYNOPSIS OF THE 1987-1988 RESEARCH PROGRAM
AT THE
NATIONAL WATER RESEARCH INSTITUTE**

**National Water Research Institute
Inland Waters Directorate
Environment Canada**

Publication disponible en français sur demande

RIVER MODELLING PROJECT

S. Beltaos, Project Chief



Introduction

The objective of the River Modelling Project is to develop knowledge and expertise, and to provide national leadership, on river flow and basin processes and their interaction with water quality and resource issues. Current emphasis is on runoff processes and transport of contaminants through the land-water interface; hydraulic characteristics of river channels and sediment mobility; transport of fine sediments and associated contaminants in rivers; development of remote sensing capabilities for measuring important river quality parameters; and river ice processes with emphasis on ice jams and frazil ice. Modelling expertise in this project also supports activities in other NWRI Projects. There is extensive interaction with the LRTAP Project for expert systems development of acid rain models.

Research Highlights

- In response to IJC concerns, field investigations were carried out on the nature of non-point source loadings to the Upper Great Lakes Connecting Channels. Non-point sources in Windsor, Sarnia and Sault Ste. Marie were found to produce loadings comparable to point source contributions for chloride, total phosphorus, several heavy metals and various persistent toxic chemicals (PAHs, PCBs and HCB).

- The fate of many contaminants in rivers is largely governed by the hydrodynamic behaviour and transport of fine sediments. Research plans are now in place to address biogeochemical processes, including flocculation, in the laboratory. New equipment has been acquired and existing mathematical models of fine sediment transport critically reevaluated. A two-dimensional version of the MOBED model, nearly completed, will predict changes in channel cross sections and associated bed shear distributions which partly control fine sediment processes.

- Transport studies of chlorinated contaminants in the St. Clair and Detroit rivers have indicated that suspended sediments are the principal pathway for these pollutants. The amount of contaminant transported by the bed load was negligible.

- A mathematical model has been developed and validated to predict the impact of prolonged water level changes on an areal extent of shoreline marshes. Marshland area is related to onshore and offshore slopes, changes in water level, and marsh depth (Figure 6).

- Analysis of unique ice jam configuration measurements was completed. It has been possible to obtain direct field estimates of several theoretical parameters which, in

the past, were either guessed indirectly or unknown. An analysis of ice jam stability when overlain by sheet ice was also carried out and applied to measured data. Laboratory tests on the breaking of ice covers by

water surges continued, using SYGICE, a synthetic material developed at NWRI. The results to date confirm theoretical predictions that uncommonly steep surges are required to break an ice cover.

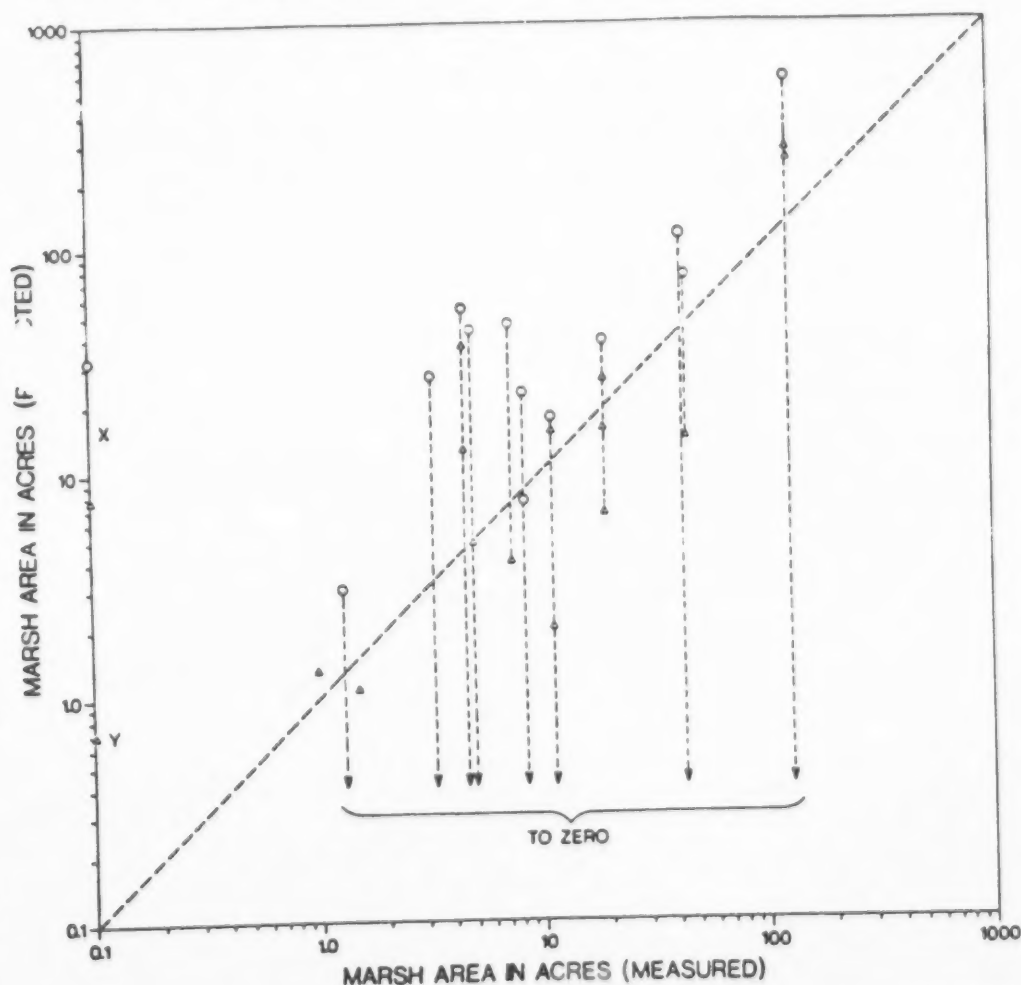


Figure 6. Validation of the geometrical marsh model. Comparison of maximum and minimum marsh area as predicted from the marsh model with actual marsh areas delineated from aerial photos for Georgian Bay/North Channel marshlands. Historical aerial photography obtained between 1935 and 1985 was utilized in conjunction with monthly water levels during this interval to effect the model validation.

NUTRIENT/CONTAMINANT INTERACTIONS PROJECT

J.H. Carey, Project Chief



Introduction

Research and management of the eutrophication issue and the contaminants issue have historically been undertaken separately. Contaminant research has largely focused on environmental pathways of specific chemicals, whereas eutrophication research has focused on the relationship between nutrient inputs and biological productivity as mediated by physical processes. Although the management of both issues is largely based on setting "objectives", nutrient objectives seldom consider the presence of persistent contaminants, while contaminant objectives rarely, if ever, consider the trophic state of the system.

The rationale for the Nutrient/Contaminant Interactions Project is that contaminant dynamics and effects in aquatic systems are directly influenced by trophic state of the system. Therefore, the eutrophication and contaminants issues should not be considered separately. The objective of the project is to characterize and eventually to quantify the critical processes controlling the interaction of nutrients and contaminants in lakes. Although much of the knowledge will be applicable to many lakes, the major focus is on the Great Lakes, where nutrient control programs currently in place could serve unintentionally to increase contaminant concentrations in fish and other biota. A multidisciplinary approach is being employed to examine the general hypothesis that nutrients interact with contaminants by influencing four processes: bioaccumulation, degradation, sedimentation and transport. To avoid the influence of multiple point sources and to provide a wide range in water chemistry, much of the work is being conducted in a series of headwater lakes (within the Great Lakes basin) differing in limnology and receiving only atmospheric inputs of contaminants.

Research Highlights

- Contaminant analyses were completed on zooplankton samples obtained at 28 headwater lakes in eastern Ontario and the results examined for correlations with limnological or water chemistry parameters. An inverse relationship was discovered between the productivity of the lake, as indicated by spring total phosphorus, and the total polychlorinated biphenyl (PCB) concentration in the zooplankton (Figure 1). If applicable, such a relationship will have significant implications for the Great Lakes toxics and eutrophication programs.

- The effect of nutrients on contaminant biodegradation (pentachlorophenol) was investigated in a set of microcosms to which nutrients at different concentrations were continuously supplied. Prior to the addition of the pentachlorophenol (PCP), most of the nutrients were incorporated into the algal fraction. Upon addition, the PCP, which is toxic to algae, caused an immediate reduction in primary productivity. The resulting nutrient release from the dead algae caused an increase in bacterial numbers and a resulting enhanced degradation of PCP.

- There is increasing evidence regarding the importance of reductive processes in the degradation of contaminants. Since eutrophic systems are more prone to anoxia, it follows that reductive processes will be more important in eutrophic systems. A study was conducted on the reductive dehalogenation of organochlorine compounds with reduced hematin, an appropriate model reaction. Differences between the reactivity of aliphatic and aromatic organochlorines were observed. These results suggest that hematin is likely important for the dehalogenation of aliphatic, but not for aromatic organochlorines.

● A collaborative study on the photolytic production of hydrogen peroxide from naturally occurring dissolved organic matter was begun. Considerable site-to-site variation was found in production rates and steady state concentrations of peroxide. Hence, the rates of contaminant degradation via this route are liable to be variable.

● Sedimentation and sediment transport are important factors influencing the fate

and distribution of persistent contaminants in lakes and require further study. At present there is no reliable method for integrating sediment fluxes in high current environments characteristic of shallow lakes. Work was begun on the development of a low-cost sediment trap capable of functioning under these conditions. A preliminary design is being evaluated to determine the influence of currents on catch efficiency.

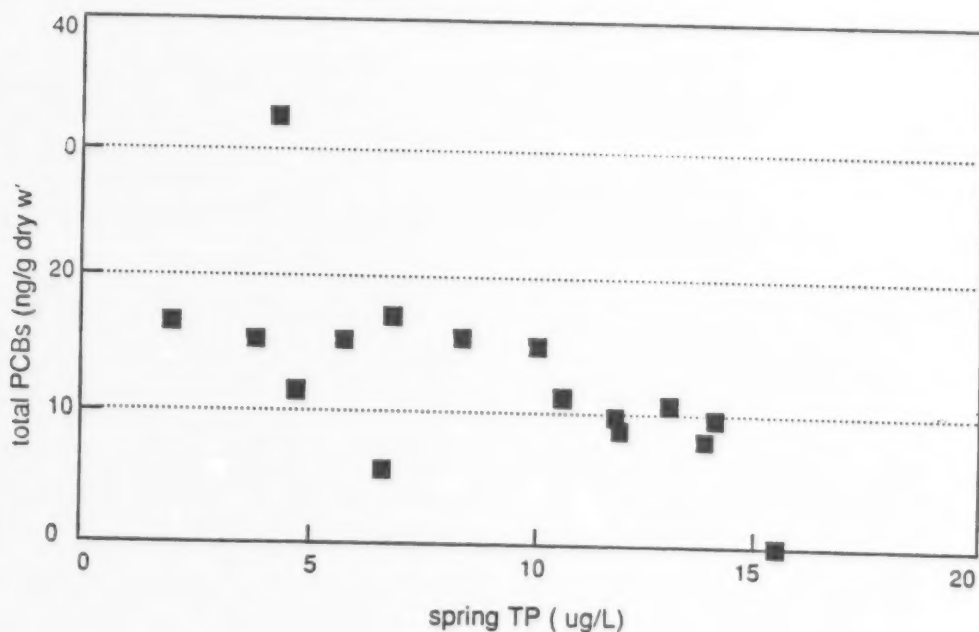


Figure 1. Relationship between spring total phosphorus and zooplankton total PCB concentrations in 28 lakes in Eastern Ontario.

LAKES RESTORATION PROJECT

M.N. Charlton, Project Chief



Introduction

Lakes, reservoirs and embayments in large water bodies do not always respond adequately to pollution controls implemented to attain specific water quality objectives. Such situations can be caused by the presence of contaminated sediments or by continuing input of pollutants from uncontrollable diffuse sources in the drainage basin or from the atmosphere. Other problems for water use can be the invasion of aquatic weeds, siltation and oxygen depletion.

Effective management of such water bodies may require basin-wide land use controls, which can take many years to implement, or they can be tackled directly by *in situ* treatment. The long-term goal of this project is to identify critical geochemical processes that can be manipulated so that *in situ* remedial technologies for the practical restoration of lakes and reservoirs can be devised, evaluated and implemented. Particular emphasis is currently placed on Areas of Concern in the Great Lakes, especially Hamilton Harbour (Figure 4), but several studies are ongoing in western Canada and in smaller lakes in Ontario.

Research Highlights

- Oxygen concentrations and consumption rates in Hamilton Harbour were examined from historical data and were found to be similar to those of today. The rates, however, were 2 to 8 times greater than that required to explain current annual decreases in oxygen. The influx of cool oxygenated water from Lake Ontario may be compensating for the high depletion rates. Incursions of Lake Ontario water into the harbour were documented using instrumentation designed at NWRI for profiling oxygen, conductivity, pH, turbidity and temperature.

- A pilot-scale injection of pure oxygen was conducted in the shallow west end of Hamilton Harbour. The efficiency of oxygen dissolution approached 90 percent for certain equipment configurations. Thus, economical applications of the technique seem feasible.

- Hamilton Harbour suspended sediments were obtained by sediment traps and continuous flow centrifugation for analysis of iron composition. Of the four iron compounds detected, two were naturally occurring forms (Fe^{2+} in chlorite clay and Fe^{3+} in amorphous iron oxides), and two forms were associated with the steel industries (hematite and wustite). The latter two were identified in plumes of Hamilton Harbour outlet water 0.5 km offshore in Lake Ontario. The sediment trap data confirmed that significant resuspension occurred even in the deepest water of the harbour.

- The distribution of sediment toxicity in Hamilton Harbour was assessed using the *Daphnia magna* bioassay. Highest toxicity was observed in areas nearest the steel industries.

- The sedimentology of Hamilton Harbour was mapped taking into account grab samples, cores and echo sounding transects. Sedimentation since the beginning of industrialization has averaged (3-4 mm/y) at depths greater than 5 m. This is twice the rate suggested in earlier studies.

- The relationship between suspended solids and water clarity was investigated in Cootes Paradise at the west end of Hamilton Harbour. Eighty percent of the suspended solids were mineral silt. At the usual concentrations of 100 mg/L, this resulted in Secchi depths of 20 cm, indicating light penetration too shallow to permit the development of emergent aquatic plants.

● Data confirmed that the lime treatment of Figure Eight Lake in Alberta (to reduce water-column concentrations and sediment releases of phosphorus) was successful. Total phosphorous concentrations were reduced by 50 percent, and significant reductions occurred in summer chlorophyll levels and oxygen depletion rates under ice during winter. Macrophytes were also reduced. Iron analyses by Mossbauer spectrometry indicated that FeS_2 precipitation was

inhibited in the past by the presence of copper sulphate, used previously as a remedial technique to control algae.

● An innovative apparatus for differentiating between P released from sediments and from freshly deposited materials was used to assess internal loading at several sites in the Bay of Quinte, Ontario. Rates of P release were as high as $9.3 \text{ mg P/m}^2/\text{d}$ even in well-oxygenated conditions.

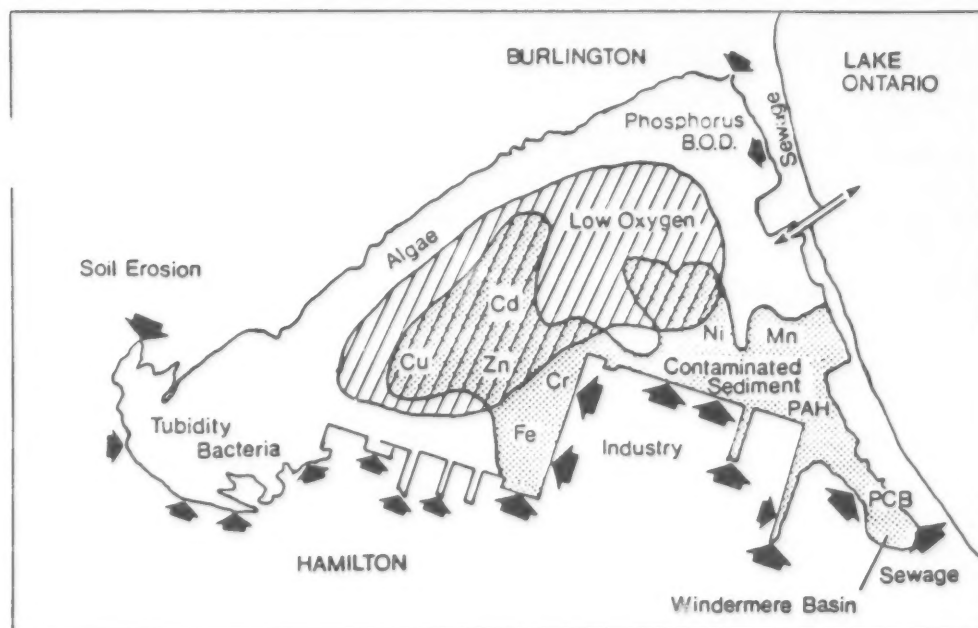


Figure 4. Hamilton Harbour: The pollution effects of industrial discharge, sewage treatment plants and sewer overflows.

ECOTOXICOLOGY PROJECT

B. J. Dutka, Project Chief



Introduction

Ecotoxicological and microbiological tests are among the most important tools for assessing the impact of pollutants on the quality of water, aquatic sediments and biota. These methods permit a determination of the degree of contamination in the environment and the identification of potential ecological impacts. They also provide important insights into a variety of contaminant/biota interactions such as acclimatization; transport rate in fluvial systems; biodegradation, bioaccumulation and food chain effects; growth stimulation or inhibition; and the effects of remedial activities.

The immediate objectives of the Ecotoxicology Project are to improve knowledge of contaminant/biota interactions at the organism and population levels, and to develop a "battery of tests" protocol for chemical stress assessment in freshwater systems. Once this multiple testing protocol has been developed, it will be transferred to lead operational agencies in Environment Canada and to the private sector for implementation in monitoring and regulatory programs.

The expertise in the Ecotoxicology Project is also used in the provision of scientific advice to governments and industries on microbiological problems and on methods for evaluating the ecological significance of toxic contaminants. Staff also contribute to other NWRI projects, such as the LRTAP, Lakes Restoration, and Contaminants/Pesticides projects. Testing protocols developed by the project support the federal government's BIOQUAL initiative, the Ontario government's Municipal and Industrial Strategy for Abatement (MISA) program, a number of regional management initiatives and the future requirements of the Canadian Environmental Protection Act.

Research Highlights

- Sampling of western Canadian rivers and lakes (e.g., Fraser River basin, Saskatchewan River basin and lakes on Indian reserves in northern Manitoba) was completed as part of a study to assess the "battery of tests" approach as well as the effects of organic and ultrapure water extraction of sediments on test responses. These and earlier data from eastern Canadian waters and sediments will be evaluated to select the final core "battery of tests".

- Upon request, a study of Port Hope area sediments was undertaken to ascertain the extent of impact of a local river on Lake Ontario. Generally, the "Area of Concern" for contaminated sediments was greater than had been suspected; a local sewage treatment plant was a factor in sediment contamination. The *Daphnia magna* test was found to be the most sensitive screening test.

- Oxygen injection as a means of improving the water and sediment quality in Hamilton Harbour was evaluated. Acute and chronic toxicant screening tests showed positive effects at stations near the sewage treatment plant outfall. Preliminary microbiological analyses of Hamilton Harbour also indicated no significant effects due to oxygen injection.

- Field and laboratory studies were carried out on key microbial/biogeochemical processes in an acid-stressed lake receiving excessive amounts of atmospheric sulphate and nitrate. Isotopic and diatom evidence indicated microbial sulphate assimilation. This assimilation results in alkalinity generation in anaerobic, organic-rich deeper sediments, thus providing an *in situ* lake rejuvenation process.

● Development and maintenance of safe potable water supplies require fast and economical assessments of the microbiological quality of the potable water source. With financial support from the Canadian International Development Research Centre (IDRC), coliphage was evaluated as an indicator of the sanitary quality of potable water sources. The objective is to develop a classification system based on coliphage counts and the nature of sanitary services at site.

● Combined with the above study, a variety of simple, inexpensive microbiological water quality assessment techniques for use in potable waters were evaluated. These

tests were compared with the bacteriological tests used routinely in Peru, Chile, Brazil, Singapore, Malaysia, Thailand, Morocco and Egypt, and evaluated for their effectiveness, sensitivity, cost, dependence on imported supplies and equipment, and practicality for use in understaffed, under-equipped rural laboratories. Results indicated that the use of these tests would provide for safe drinking waters and permit screening of potential sources of potable water for development. This testing protocol will be applied next year to selected areas in northern Canada not served by municipal water supplies.



Figure 9. Beginning ecotoxicological sediment studies near Saint John, New Brunswick.

NEARSHORE/OFFSHORE INTERACTIONS PROJECT

K.L.E. Kaiser, Project Chief



Introduction

Much of the pollution in lakes occurs when contaminants are released at the shoreline via rivers or industrial discharges. The pathways, fate and effects of these contaminants are complicated by the episodic nature of their interaction with the littoral zone sediments and associated biota within the nearshore zone. The objective of this project is to combine physical, chemical and limnological expertise with chemical and biological expertise to assess the transfer, degradation, adsorption, volatilization, burial, resuspension and biological impacts of contaminants in this important but poorly understood zone. Modelling is a major aspect of the project, which includes both physical hydrodynamics and chemical prediction through quantitative structure activity relationships (QSAR). Research is conducted in the St. Lawrence River, its lakes and estuary, and in the Laurentian Great Lakes Connecting Channels.

Research Highlights

- Volatile halocarbons (VHCs) were proven to be useful for tracking pollutant plumes in lakes and large rivers. The 20 compounds in this group, which are relatively easy to detect, were used to identify contamination sites in the St. Lawrence River from Cornwall to Quebec City.

"Microtox" toxicity testing was used to assess the potential effects of these contaminated plumes in the St. Lawrence River and in Lake St. Clair (Figure 5). In the St. Lawrence River, nearly 50 percent of the samples showed low to moderate toxicity.

- A preliminary survey of persistent toxic chemicals such as PCBs, chlorobenzenes, chlorophenols, PAHs and a variety of biocides, was completed for water, suspended sediments, bottom sediments and biota in the upper St. Lawrence estuary.

- Preliminary studies of the distribution and abundance of yeasts in the St. Lawrence River were completed. Yeast densities tend to increase with depth in this system.

- A variety of lake sediments from across Canada were evaluated for their potential to release aluminum. Calculated rates of sediment release were high enough to supply a significant fraction of the dissolved aluminum found in Ontario and Nova Scotian lakes.

- Processes affecting the transport and fate of chlorobenzenes in the Niagara River plume were assessed using field measurements and modelling. The key controlling factors were partition coefficients and the concentration of suspended solids.

• The episodic movement of sediments, turbulence and horizontal currents, and the resultant effects on contaminant transport were analyzed in Lake St. Clair. A new method to account for general horizontal advection, called the "flux divergence method", has been developed.

• A new version of the TOXFATE model was developed and was applied to simulation and predictive exercises for Lake St. Clair and for the waterfront area of Toronto Harbour in Lake Ontario.

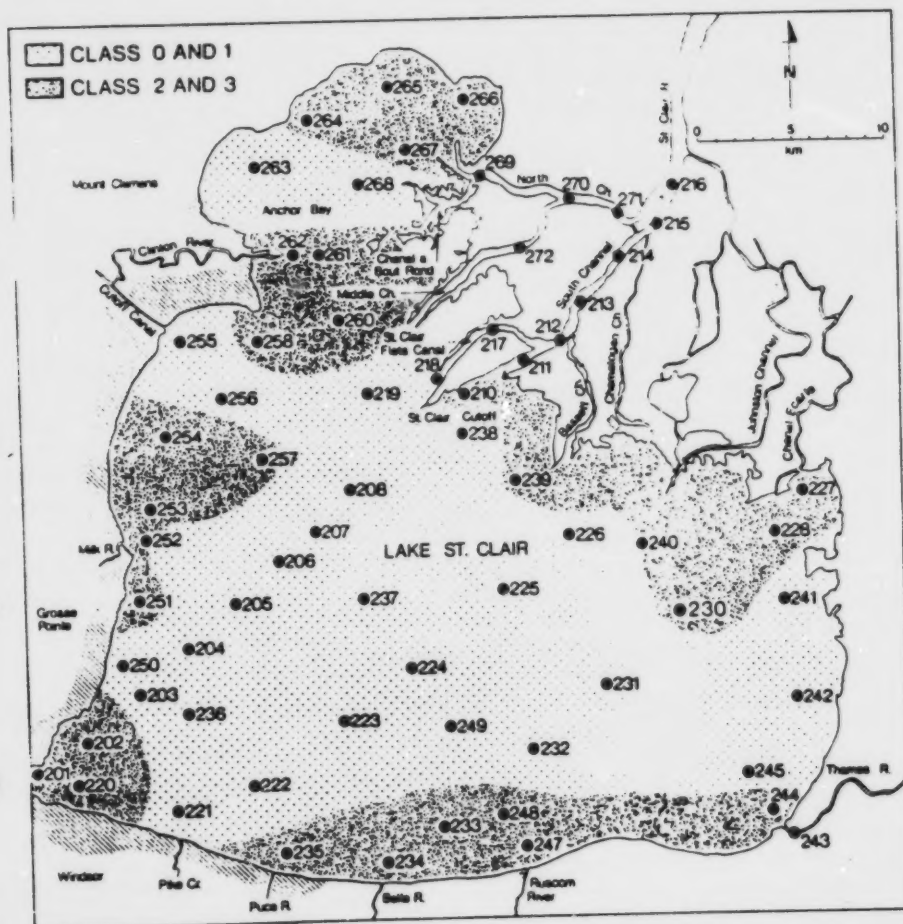


Figure 5. Toxicity survey station numbers in Lake St. Clair and Microtox toxicity test classifications of the lake water showing the absence (class 0 and 1) and the presence (class 2 and 3) of conditions producing low acute toxicity.

LONG RANGE TRANSPORT OF AIRBORNE POLLUTANTS PROJECT

D.C.L. Lam, Project Chief



Introduction

Current research with the Long Range Transport of Airborne Pollutants (LRTAP) Project is largely in response to the needs of the upcoming national LRTAP "acid rain" assessment due to be completed in early 1990. One area of emphasis has been the completion of studies on sulphur cycling and natural organic acidity. The priority for the Turkey Lakes Watershed Study has been the production of summary interpretations of earlier work and the establishment of a "maintenance" program for the field site. Priority efforts have also been made to complete predictive model development and to apply the models extensively in support of the 1990 assessment. Lastly, research has continued for the development and statistical evaluation of the national LRTAP water quality data base.

Research Highlights

- A 21-paper special review volume on the Turkey Lakes Watershed Study was published (Can. J. Fish. Aquat. Sci. 45, Suppl. 1). It spans the entire range of work that has been conducted, including aquatic chemistry and biology, forestry, and predictive modelling. The processes controlling the hydrological and chemical fluxes associated with spring melt, mass balance studies for ionic species, and aluminum geochemistry were also described at international conferences or in review papers.
- Sulphur isotopic data suggest that large amounts of sulphur are released during summer from biogenic sources such as bogs, marshes and wetlands that cover large areas of Canada. In the first measurement of its kind, large amounts of dimethyl sulphide (DMS) were shown to be produced and released from such ecosystems. Calculations

suggest that such sources can contribute up to 20 percent of the airborne sulphur in rural and remote areas of Canada. DMS is rapidly oxidized in the atmosphere by hydroxyl and nitrate ions to sulphur dioxide and methane sulphonic acid (MSA). MSA is thus a marker that can be used to assess the magnitude of the biogenic contribution to the atmospheric sulphur burden. The combined use of the isotopic and MSA data is a potentially powerful tool in acid rain research.

- Dissolved organic matter (DOM) complexes aluminum and thus may protect fish from aluminum toxicity. In cooperation with the Department of Fisheries and Oceans laboratory at St. Andrews, New Brunswick, aluminum-DOM interactions on several Nova Scotian waters are being tested, and, through controlled bioassays, their net effect on salmon alevin survival will be determined.

- Regionalization of acidification impact models may provide a more objective means to assess alternative acid rain control strategies. A prototype expert system, RAISON (regional analysis by intelligent systems on a microcomputer), was developed and shown to improve the performance of individual models (Figure 8). In a formal review of over 100 studies in the U.S. and Canada, a U.S. EPA expert research panel on modelling characterized the RAISON study as a "clear, relevant and realistic" approach. The system provides a highly flexible framework within which a wide variety of geographically based environmental problems can be effectively evaluated. Another version of RAISON has been applied to water quality problems in Malaysia.

- A simple, three-soil-layer model has been developed and verified with runoff data from Mersey River (Nova Scotia)

Northeast Pond (Newfoundland) watersheds. Simulated data for 15 and 30 years showed satisfactory results when compared with observed hydrographs. Modification of the hydrogeochemistry model was also necessary, particularly in the inclusion of the organic chemistry for the coloured waters of the Mersey River.

- An improved and more acceptable functional relationship between the aquatic

and terrestrial regime factors was applied to all the watersheds in the Province of Quebec south of latitude 52°N. The relationship permits evaluation of aquatic resources at risk in the cases where terrestrial data exist, but aquatic data are insufficient. Risk estimates indicate 4.5 percent of the lakes are in critical condition, and an additional 48.5 percent are in a very sensitive and susceptible condition.

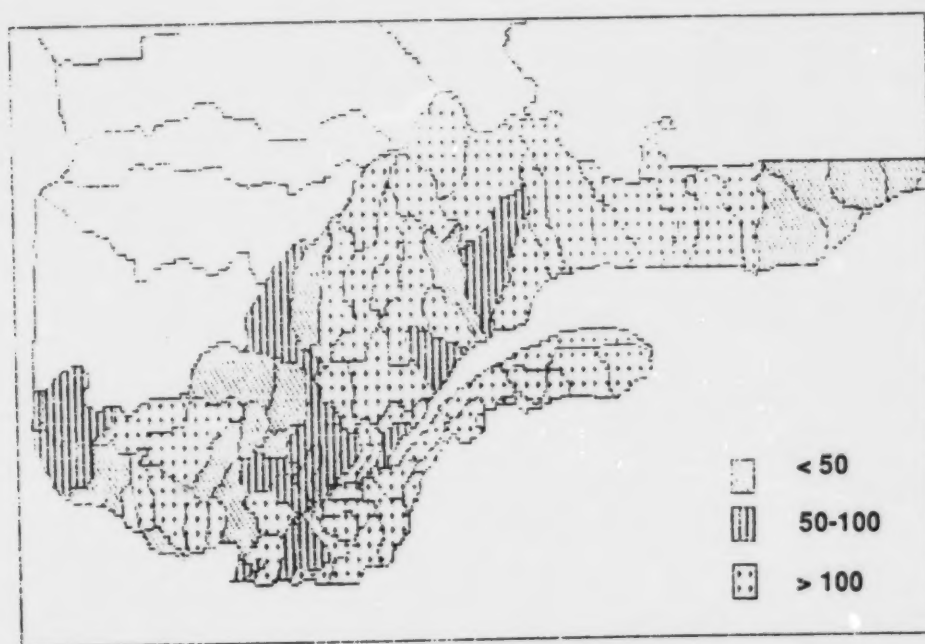


Figure 8. Predicted average acid neutralization capacity ($\mu\text{eq/L}$) for 91 watersheds in southern Quebec using the RAISON expert system under present loading condition.

CONTAMINANTS/PESTICIDES PROJECT

R.J. Maguire, Project Chief



Introduction

The general objective of the Contaminants/Pesticides Project is to develop knowledge for use by Environment Canada in assessing the hazard posed by toxic chemicals released to Canadian rivers and receiving waters. The hazard of a given chemical to organisms in water or sediment is a function of its concentration, toxicity and persistence. Research is performed in all of these areas and, in conjunction with the Ecotoxicology Project, on the determination of effects of toxic substances on aquatic communities and ecosystems. Research topics are chosen in response to a variety of concerns. These include gaps in the scientific literature, chemicals identified in priority lists for risk assessment (e.g., under the Environmental Contaminants Act, the Pest Control Products Act and, in the future, the Canadian Environmental Protection Act), or in response to regional concerns.

Research Highlights

- Tributyltin (TBT) is an antifouling agent and perhaps the most acutely toxic chemical to aquatic organisms in use. Research in this project was the first anywhere in the world on the occurrence of TBT in water, sediment and fish, and on the chemical and biological degradation and persistence of TBT in water and sediment. TBT was found to be moderately persistent in Canadian waters and present in many locations in Canada at concentrations which could cause chronic toxic effects in sensitive organisms. As a consequence, a limited ban was proposed by Agriculture Canada (under the authority of the Pest Control Products Act) on the use of antifouling paint containing TBT.

- Concentrations of 90 PCB congeners, chlorobenzenes and chlorinated pesticides

were determined in the surface microlayer and subsurface water of the Niagara River at Niagara-on-the-Lake. In general the concentration of most chemicals was elevated in the surface microlayer relative to subsurface water, by factors of up to 37. This has implications for sampling protocols and for air/water exchange processes.

- Research into biomonitoring techniques is being carried out on benthic macroinvertebrate community structure as an indicator of ecosystem health in the Yamaska River, Quebec; biochemical response of organisms to known toxicants in the Yamaska River; evaluation of fish bile as a monitoring medium for pesticides with relatively low lipid solubilities; and evaluation of freshwater mussels as biomonitors for pesticides and industrial chemicals. In studies of a pulp mill and a wood preserving plant on the Rainy River and at Thunder Bay, caged leeches were shown effective for monitoring of chlorophenols. Tetraethyllead was produced at one location on the St. Clair River and at another location on the St. Lawrence River. Decreases in alkyllead concentrations in fish and caged clams, but not in sediment downstream of these two sites, have been noted following the cessation of production.

- Deltamethrin, a pyrethroid insecticide, is the most powerful insecticide known. Earlier work on the persistence of deltamethrin in water had not taken into account that sunlight can convert deltamethrin to relatively non-toxic isomers, in addition to degrading it. Deltamethrin, when sprayed on a pond and stream in Prince Edward Island, disappeared quickly from water, with a half-life of about one hour (Figure 7).

- A rapid and sensitive agar plate assay for the microbial toxicity of org

contaminants has been developed. The method involves the use of a dimethyl sulphoxide-glycerol carrier solvent system to dissolve the test chemicals and the incubation of a seeded agar plate at 30°C to accelerate the bacterial growth rate. Bacterial responses to tripropyllead and trimethyllead could be detected at quantities as low as 200 ng. In addition, an oxygen-uptake toxicity assay was developed for directly assessing the microbial toxicity of Hamilton Harbour sediments, yielding results

compatible with the *Daphnia magna* test.

- A high performance liquid chromatography (HPLC) method has been developed for the determination of adenine nucleotides (ATP, ADP and AMP) in studies of stress in algae using the adenylate energy charge ratio technique. Preliminary studies in the Yamaska, St. Lawrence and St. Clair rivers indicate that eutrophic conditions interfere with these analyses.

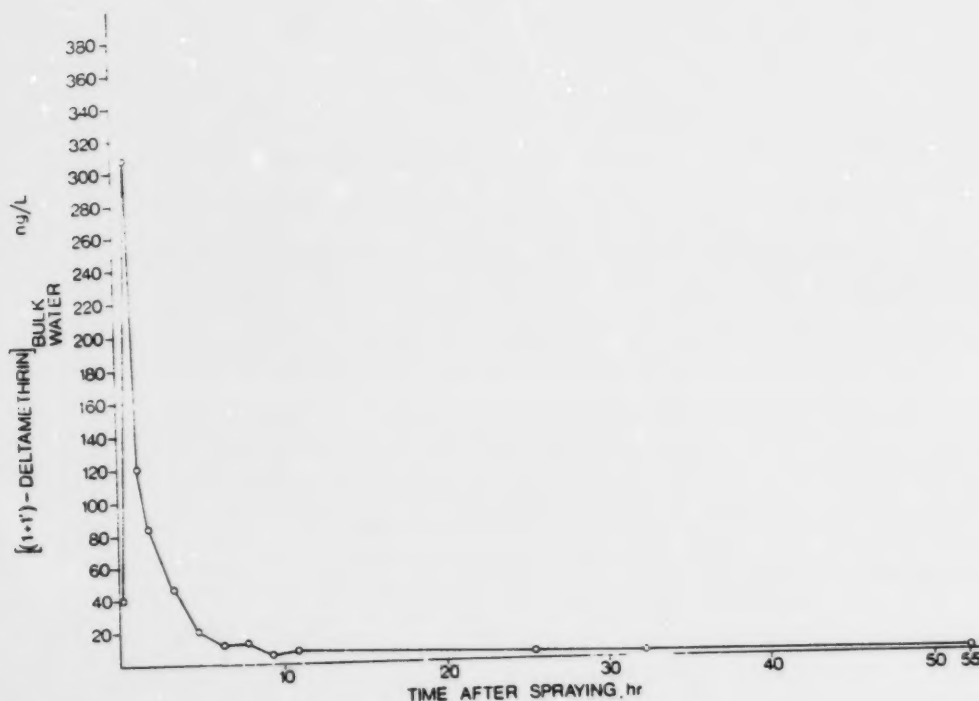


Figure 7. Disappearance of deltamethrin from pond water in P.E.I. following aerial application.

SEDIMENT/WATER INTERACTIONS PROJECT

A. Mudroch, Project Chief



Introduction

Most persistent hydrophobic and toxic organics, metals, radionuclides, and nutrient contaminants are associated with bottom sediments in aquatic environments. Consequently, sediments can serve as an *in situ* source of pollutants which can be recycled into the water column and its food webs. A prerequisite for the development of remedial measures for toxic contaminants in lakes and rivers is an understanding of sediment quality, particularly the quantification of biological and physico-chemical processes affecting the release and availability of sediment-associated contaminants. These pathways and processes are still poorly understood, as are their rates, controlling factors and relative degree of importance.

The objective of the project is to develop sufficient information on the biological, geochemical and sedimentological processes which define the pathways, availability and release of sediment-associated contaminants (Figure 2) in order to propose effective rehabilitation measures for aquatic ecosystems containing polluted sediments, particularly for the Areas of Concern in the Great Lakes.

Research Highlights

- The role of oligochaetes in contaminant mobilization was investigated using three C^{14} -labelled organic compounds: DDE, HCB and PCB (congener 153). Equilibration time was relatively rapid and varied from 6 to 16 days to attain 90 percent of maximum accumulation.
- The potential for terrestrial plants to mobilize contaminants from polluted sediments in confined disposal facilities was studied. Initial analysis has revealed significant differences between plant species commonly found in such facilities.
- The dynamics of fine-grained sediments were studied using artificial tracers at the mouth of the Humber River, Ontario. Silt-sized sediments were initially deposited near the mouth, but physical processes in the lake transported these materials along the western shore of Humber Bay and then into the profundal zone of Lake Ontario.
- Geotechnical testing of sediment cores in Lake Erie was undertaken to assess the relative intensities of sediment settling, resuspension and transport. Data from the western and eastern basins indicated intensive resuspension and transport while central basin core showed a history of continuous and regular deposition.
- Resuspension and sedimentation studies in Lake Erie demonstrated that sedimentation was ten times higher in winter than in summer. In addition, sediments collected in sediment traps were richer in PCBs during winter than in summer. The source of these sediments may be the Western Basin.
- The response of Lake St. Clair, a shallow riverine system, to the possible cessation of heavy metal input was examined using mercury as the trend indicator. Concentrations, although decreasing in the upper surface sediments between 1974 and 1985, still indicate continuing inputs of mercury to the lake. Coarse-grained sediments in the upstream river were identified as the probable source of contamination.
- Research continued on the compositional pattern of PAH (polyaromatic hydrocarbon) components in water, sediment and suspended sediments in many localities.

across Canada (e.g., the Mackenzie, St. Lawrence and St. Marys rivers, Thunder Bay and Hamilton Harbour). Composition was highly variable and dependent on the site and the nature of the sources.

- Research on the pathways of radionuclide distribution was undertaken adjacent

to a radioactive waste management site. Migration of uranium and radium in groundwater entering Lake Ontario was confirmed. Various rainfall samples and receiving environments were also examined following the Chernobyl incident. Four phases of Chernobyl radionuclide deposition reached Canada via westerly and northerly winds.

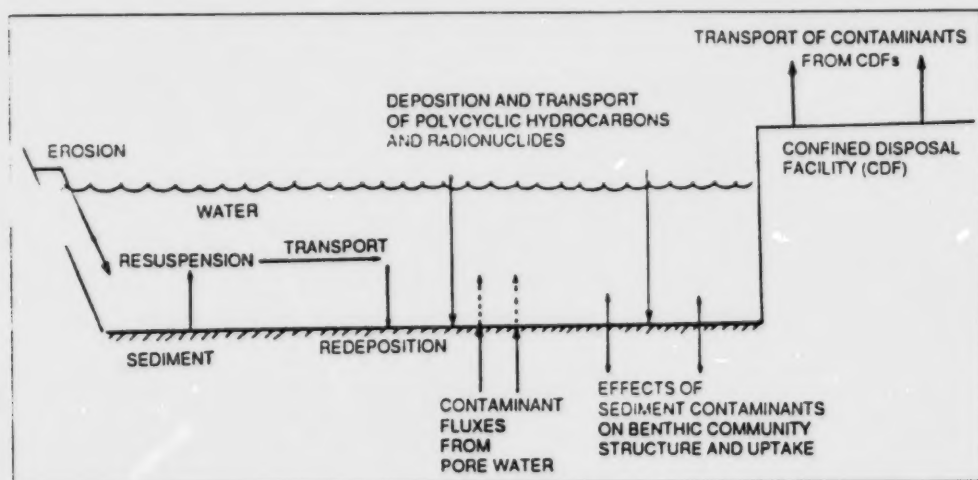


Figure 2. Processes studied within the Sediment/Water Interactions Project.

GROUNDWATER CONTAMINATION PROJECT

R.E. Jackson, Project Chief



Introduction

The Groundwater Contamination Project focuses on the migration and fate of toxic contaminants in groundwater using instrumented field sites, laboratory experiments and mathematical models. The project has three general objectives:

- to understand the physical and chemical controls on contaminant migration and fate in sedimentary rock aquifers, such as liquid industrial wastes in the bedrock of the Niagara region and pesticides in sandstones underlying Prince Edward Island (P.E.I.);
- to develop and/or apply operational tools for hazardous waste site assessment and restoration of outwash aquifers;
- to provide expert advice on groundwater pollution matters of federal concern in Eastern Canada.

Research Highlights

- Cooperative work with the U.S. Geological Survey along the Niagara River frontier is underway to determine the hydraulic properties of the bedrock flow system and the overall groundwater flow pattern. Preliminary results show that groundwater is flowing primarily in the downward direction towards a pervasively low hydraulic head feature at about 120 m depth that is well connected laterally to the Niagara Gorge. Low permeability shales and sandstones in the Clinton group act as aquitards to prevent a significant volume of water from discharging into the Niagara River.
- The freshwater aquifer in the St. Clair River Valley around Sarnia, Ontario, was determined to contain small quantities (i.e., 1 to 10 ppb) of phenol and some volatiles. The results will contribute to the

development of a regional model of groundwater flow for Lambton County.

- Research on the hydrogeology of contaminant transport in fractured rocks has centered on the development of a field site at Clarkson, Ontario, and on a methodology for the determination of the aperture distribution of a natural rock fracture using slug tests. The tests were conducted in both open-wellbore and shut-in formats, where up to five successive increases in the volume of injected water were used to investigate fracture aperture heterogeneity.
- Groundwaters of the Gloucester Landfill, situated near the Ottawa International Airport, are contaminated with organic chemicals from incineration of tory solvent wastes between 1968 and 1970. NWRI is part of an anticipatory research study to determine optimal methods for aquifer restoration. Studies on laboratory simulation of organic contaminant retardation, on field assessment of organic contaminants in groundwater, and on computer simulation to optimize the configuration for four purge wells for aquifer restoration were completed this year.
- Results of a study on radionuclide transport in a sand aquifer at Chalk River, Ontario, indicate that distribution coefficients for strontium-90 are most strongly affected by spatial variations in the adsorption capacity of the aquifer, as estimated by the specific surface area, rather than by variations in the concentration of competing cations (Figure 10). The adsorption of strontium-90 appears dominated by specific adsorption to Fe/Mn/Al oxide coatings on sand grains rather than by electrostatic adsorption, i.e., by classical cation exchange.
- Studies on the fate of the pesticide aldicarb in the sandstone aquifer of

focuses on migration and fate following application of the chemical to potato crops. High aldicarb values ($>5 \mu\text{g/L}$) rarely appear, except in conjunction with elevated nitrate concentrations ($>10 \text{ mg/L}$). Degradation of fertilizer residues on P.E.I. appears to inhibit the degradation of the pesticide residues and could be avoided by pesticide application

following plant emergence in late June, rather than prior to seeding in May. The ratio of aldicarb sulphone to total aldicarb was also found to vary greatly. In the highly oxygenated groundwaters of P.E.I., the ratio is frequently >0.60 compared with 0.40 to 0.48 reported for aldicarb-contaminated groundwaters in the United States.

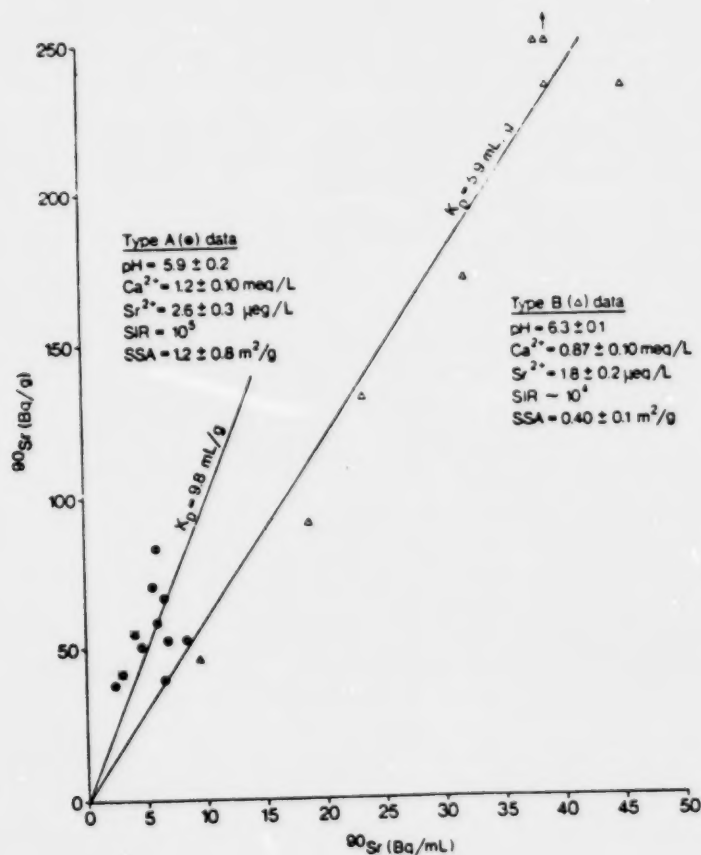


Figure 10. Linear adsorption for ^{90}Sr uptake in two parts of a radioactivity-contaminated aquifer at the Chalk River Laboratories, Ontario. Type A data indicate a geochemical environment in which competition between hydrogen, calcium, strontium and radiostrontium ions is greater than with type B data. The linear adsorption partition coefficient K_p is greater for type A data, despite the higher competitive effects, because of the higher specific surface area (SSA) of the aquifer sediments in the type A data. SIR represents the strontium isotope ratio of stable strontium to ^{90}Sr ions.

ANALYTICAL CHEMISTRY PROJECT

I. Sekerka, Project Chief



Introduction

The continuing goal of the Analytical Chemistry Project is to advance knowledge and provide expertise on environmental analytical chemistry. New analytical protocols, instrumentation and methods are essential for the assessment and management of water resources and innovative water pollution research, especially the identification of emerging problems. Both basic and applied, mission-oriented research in environmental analytical chemistry is conducted. New, improved and effective analytical techniques, including laboratory automation, are developed and evaluated for measuring priority chemical parameters. Technology-transfer recipients include other research and operational branches of Environment Canada as well as provincial and private-sector environmental laboratories in Canada and abroad.

The objectives of the project are: to develop new and improved analytical methods as well as screening and sampling procedures which are accurate, cost-effective, sensitive and unambiguous for the identification and quantification of contaminants in aquatic ecosystems; to play a lead role in documentation, validation and standardization of analytical methodologies to ensure accuracy and reliability of analytical data; to provide NWRI with sophisticated instrumentation and facilities such as gas chromatography/mass spectrometry (GC/MS) and the Clean and Hazardous Chemical Laboratory; and to transfer developed methods and technologies to the national and regional laboratories of IWD and a wide variety of other "clients" (Figure 11).

Research Highlights

- A fully automated, ion-chromatography method was developed for the measurement

of cadmium in water samples at sub-parts per billion (ppb). The detection limit of 0.1 ppb exceeds the existing water quality objective of 0.2 ppb and will substantially improve the capability to provide baseline data on cadmium.

- A comprehensive method for simultaneous determination of 20 chlorophenols and 21 chloroanisoles in fish was developed. This will improve studies on the pathways and degradation of chlorophenol, and on the potential environmental hazard of chloroanisoles in areas such as the Fraser River, British Columbia, where chlorophenols are in heavy use.

- A simple, inexpensive, ion-exchange cartridge suitable for "in-line" pre-treatment of ionic species was developed. This permits improved detection limits for the atomic absorption determination of heavy metals (part per trillion range). Its incorporation into inductively-coupled plasma emission spectrometry will permit detection limits that exceed the very low levels of contaminants present in precipitation samples.

- A method for the determination of non-ionic surfactants by supercritical fluid chromatography (SFC) was developed. This is the first quantitative method ever developed for SFC. SFC methods have the potential to provide national and regional water quality laboratories with alternative analytical methods where gas chromatography (GC) and liquid chromatography (LC) are not suitable.

- A working version of a radioimmunoassay (RIA) technique for dioxin detection was achieved. RIA is used to screen large numbers of samples rapidly identifying those that are dioxin-free, and thus eliminating the need for their analysis by other costly

consuming techniques. A detection limit of 5 picograms (50 ppt) for TCDD (tetrachlorodibenzo-p-dioxins) was achieved using a lake trout matrix; this is comparable to standard chemical detection methods.

- Improvements to clean up procedures for chromatography, especially for dioxins, were made through development of a first generation of graphite-fibre clean-up columns and an effective process for activating the graphite fibres. The columns are suitable both for GC and LC applications.

- Improved methodologies for organochlorines and PCBs were developed that produce high quality, highly reproducible

chromatographs in the dual column, splitless-split injection mode. These methods are a considerable improvement over existing techniques, both in terms of accuracy and precision.

- A validation program for the 24-hour Goulden large sample extractor (GLSE) was completed. This led to acceptance of the GLSE for field use in sampling organic contaminants under the Canada-U.S. Niagara River Toxics Management Plan. The U.S. Environmental Protection Agency and University of Minnesota have also selected GLSE technology for use in a major water quality survey of Green Bay, Wisconsin. Initial steps are being taken to have the GLSE commercially manufactured.

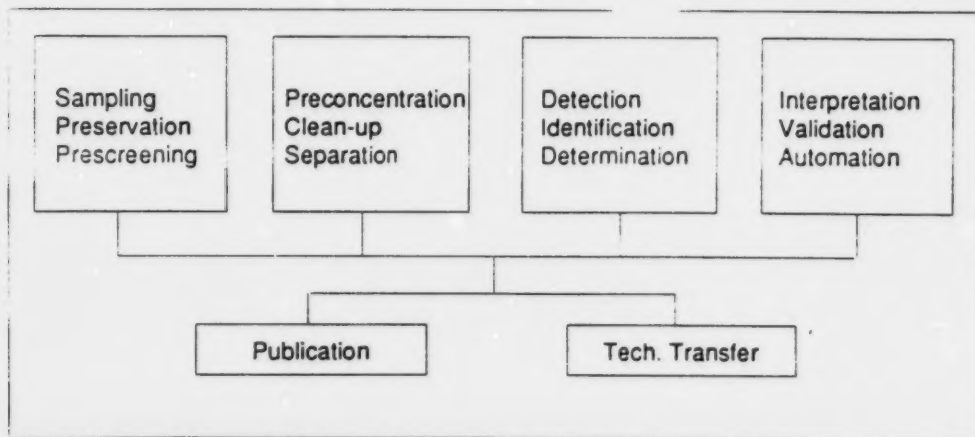


Figure 11. General summary of the research functions within the Analytical Chemistry Project.

AIR/WATER INTERACTIONS PROJECT

W.M. J. Strachan, Project Chief



Introduction

Widespread pollution of surface waters occurs in areas of Canada without known point sources for the contaminants involved. Deposition from the atmosphere of many of the same compounds has been established as a major route for the contamination of the Great Lakes and has been highlighted by the Canada-U.S. International Joint Commission (IJC). There is also evidence that an unknown fraction of the contaminants once deposited is revolatilized into the atmosphere. Hence, there is considerable scientific uncertainty over the amount and significance of the net input (or loss) of such substances from the atmosphere to the water.

One of the major goals of this project is to estimate the transfer of toxic chemicals between the atmosphere and the aquatic environment. To do so, concentrations of the chemicals in a variety of land, air and water subcompartments as well as the coefficients for the interface processes are both needed. The former requires extensive data obtained by ongoing monitoring efforts, analysis of samples and field research. The latter, on the other hand, requires complex laboratory experimentation. To date, monitoring has focused on the biota of aquatic systems and has not addressed the question of contaminant concentrations in the basic environmental compartments (sediments, suspended solids, dissolved airborne particulates, vapour state and rain/snow). Laboratory determination of transfer coefficients has only just begun.

The second aspect of air/water interactions addressed by this project is climate change. Climatic fluctuations have had considerable impact on water quality in Canada. Variations in incident energy can substantially

alter the structure of lakes and indirectly affect nutrient fluxes, oxygen conditions, chemical budgets and biological productivity. Modelling the effects of energy-budget changes in the recent past on various limnological processes may provide a basis for predicting long-term effects on water quality. Climate change will alter the exchange of materials between the atmosphere and lake surfaces and it is important to quantify the scale of this response.

Research Highlights

- Easily measurable concentrations of organochlorine pesticides, PCBs, chlorobenzenes and PAHs were observed in rain samples collected across southern Canada (Figure 3). Most concentrations were in parts per trillion range or lower.
- A prototype, all-weather sampler was developed and tested during rain and snowfall events. Through the use of exchange resins, the sampler can isolate samples for organic and inorganic substances, and for metals in wetfall precipitation.
- The use of the bog plant *Sphagnum fuscum* to assess the transport and deposition of arsenic, selenium and cadmium, was evaluated at 37 sites across Canada. Elevated concentrations were observed near major mining and refinery sites (e.g., Flin Flon, Manitoba; Atikokan, Ontario; and Rouyn-Noranda, Quebec). The data base for arsenic was extensive enough to calculate an average background level in the moss of 0.66 mg/kg for areas not affected by these point sources. Near smelters, maximum values up to 31.0 mg/kg were measured.
- The radiological risk for fish and benthic organisms living in or near sediments contaminated with radionuclides

evaluated. The dose rates at the sediment/water interface were assessed and internal dose rates for biota of different sizes and locations relative to the sediment were calculated. Fish living near the sediment off the Gunnar Mine on Lake Athabasca can receive up to 100 milli-Grays/y (background exposure, 1 mGy/y).

- The transport and fate of radionuclides in Niagara Falls water was investigated. Most radionuclides were transported in suspended sediments which accumulate in the waters off the Niagara bar of Lake Ontario, but a significant fraction was observed in the foam accumulating below the Falls.

Engineering design and partial construction of a wind-wave flume to measure mass transfer coefficients of volatile organic contaminants were accomplished. The flume will be completely sealed so that

water and air concentrations of contaminants can be separately measured and related to wind speed and wave conditions.

- A paleoenvironmental model which relates ostracode species composition in lake sediment cores to climate conditions was refined with the addition of lead-210 dates from three cores in Saskatchewan lakes. The date of influx of Russian thistle pollen found in these cores was also established.

- Evaporation over the lower Great Lakes was reevaluated using a variation of the mass transfer approach in which evaporation is modelled as a function of wind speed and vapour pressure difference between the lake surface and overlying air. The procedure compares favourably with other methods.



Figure 3. Toxic rain research sampling sites in Canada.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORKSURVEY QUESTIONS

Your Name: R.G. LAUFORD

Telephone: (306) 975-5775

Title: CHIEF HYDROMETEOROLOGICAL RESEARCH DIVISION

Address: NATIONAL HYDROLOGICAL RESEARCH CENTRE
11 INNOVATION BLVD

SASKATOON, SASK.

S7N 3H5

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

THE QUANTITY AND DISTRIBUTION OF WATER
RESOURCES

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Project #270

INDICATOR RESEARCH PROJECT DESCRIPTION,

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Use of Remotely Sensed Data in
Hydrologic Models

Project objective(s)

- ① Investigate the utility of satellite data for modelling of streamflow.
- ② Develop a more physically-based distributed hydrologic model.
- ③ Adapt a hydrologic model as a land-phase component of a global circulation model.

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

- ① Kootenay basin - S.E. BC
- ② Souris basin - Sask/Manitoba

Project #271

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Climatologic and Hydrologic Variability
and Change in the Red River Basin

Project objective(s)

1) to find the relationships between
surface climatology, hydrology and upper
atmospheric climatology for the Red River Basin.
2) identify possible impacts of Greenhouse gas
enhanced climatic warming on the hydrology of
the Red River Basin

Geographic scope (circle one)

global

national

☒ regional

local

If regional or local, what is the geographic area covered?

Red River Basin in the U.S. and
Canada

Project #272

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

General Circulation Model

Verification

Project objective(s)

To verify the surface climatologies of selected general atmospheric circulation models against known Canadian surface climatology to enable the assessment of potential accuracy on a regional basis of model runs for a doubled carbon dioxide atmosphere.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

ENVIRONMENT CANADA:
SUSTAINABLE DEVELOPMENT

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: ED WIKEN Telephone: 997-1090
 Title: CHIEF, ECOLOGICAL APPLICATIONS RESEARCH DIVISION
 Address: 351 ST. JOSEPH BLVD, HULL (10TH FLOOR,
PLACE VINCENT MASSEY, OTTAWA, CANADA K1A 0H3)

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The wise use and management of Canada's ecological resources and ecosystems is fundamental to the achievement of environmentally sustainable development. The Division's indicator research provides comprehensive national and regional data bases on ecosystem capability and response to environmental stresses, on ecosystem quality, use, and on dynamic change in its use and quality. With the use of advanced computer information systems, these data are combined with other environmental and socio-economic data, information and applied to priority departmental issues such as climatic change and acid precipitation, sustainable development, environment-economy linkages, degradation and use of prime lands such as wetlands, etc.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

*1. Dr. K.W.G. Valentine, Soil Inventory Section, Land Resource Research Centre, Agriculture Canada, Nepean Bldg., Ottawa K1A 0X6. 995-501. (LRRC research also includes land degradation, environmental quality, etc).
 2. Dr. Fred Pollett, Forestry Canada, Petawawa Forestry Institute, Chalk River, Ontario K0J 1P0.
 Also at Petawawa Nat. For. Inst., Forstats (see attached brochure)*

** OR CHARLES TARNOCK ; KEITH MAY STILL
 BE IN AFRICA*

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

ECOLOGICAL RESOURCE DATA BASES (ECOLONES, ECOPROVINCES, ECOREGIONS, ECODETRICTS, ECOCUMATIC PROVINCES AND REGIONS)

Project objective(s)

To provide integrated ecological data on Canada's ecosystems for use as indicators of the status of Canada's environment in terms of quality, quantity, use, and value of the country's sustainable resources.

Geographic scope (circle one)

global

national

regional

local

MOST
SOME

If regional or local, what is the geographic area covered?

Depends on study within the overall project. Examples could be the Arctic, the Atlantic coastline, the NWT mainland, the Prairie Provinces, etc.

FISHERIES AND OCEANS CANADA



Fisheries and Oceans Pêches et Océans

Newfoundland Region
P. O. Box 5667
St. John's, Newfoundland
A1C 5X1

Your file Votre référence

Our file Notre référence

OCT 17 1989

Mr. Greg Sheehy
Environmental Consultant
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

Subject: SOE Reporting

This is to acknowledge and thank you for your letter of September 29, 1989 concerning the above.

This region is presently involved in contributing to the "Fisheries" and "Oceans and Coastlines" chapters which DFO is contributing to the proposed 1992 SOE Report, so we are quite familiar with Environment Canada's State of the Environment reporting system.

As you are probably aware, Science Branch in the Newfoundland Region is one of six regional Science Branches across the country. Each of these Science Branches conducts annual Program Review and Evaluation (PRE) planning exercises each December. Most regions primarily produce documentation of their research achievements for the past year and proposed research activities for the coming year.

I have attached the 1988 PRE document for Science Branch, Newfoundland Region, which I trust you will find useful. Please advise me if you concur with the approach and if the information is sufficiently detailed for your needs. If you find the PRE document useful, we can place you on our mailing list. You should be aware that the 1989 PRE document will be available sometime in March of 1990, and will document 1989 research achievements and departmental research plans for 1990/91.

You may find the index helpful as a quick reference to various categories of research activities.

. . . 2

Canada

Greg Sheehy

2

I draw your attention particularly to the Fisheries Ecology Sections of our Groundfish and Pelagic Fish, Shellfish and Marine Mammals Divisions, the Habitat Research and Assessment Section of our Experimental Sciences Division, and Toxicology Section of our Oceanography, Hydrography and Toxicology Division as being particularly well-suited to your research indicator needs.

For the purposes of continuity, I suggest I remain the primary point of contact for this initiative. I trust you will find our PRE documentation useful in extracting the information you are looking for. If I can be of further assistance, please do not hesitate to contact my office.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'M. C. Mercer', with a long horizontal flourish extending to the right.

M. C. Mercer
Regional Director, Science

Attach.

GROUNDFISH DIVISION
D. B. ATKINSON (ACTING)

1. Introduction

The Groundfish Division has a mandate to provide biological advice to support sound management of commercially and potentially commercially important groundfish species in the Newfoundland-Labrador area so as to yield maximum social and economic benefits for Canada. Such advice is provided both to national and international managers.

In exercising this mandate, the Division utilized 60 Continuing Full Time (CFT) positions in 1988, 3 of which are occupied by the Division Head and secretarial support. The remaining 57 CFT positions were distributed amongst six sections as follows: Gadoids Section (16 CFT), Flatfish Section (13 CFT), Redfish Section (7 CFT), Canadian Port Sampling Section (7 CFT), Observer Program Sampling Section (4 CFT), and the relatively new (established in 1987) Fisheries Ecology Section (10 CFT).

The species Sections conduct investigations into the biology and dynamics of gadoid species (cod and haddock), flatfish species (American plaice, yellowtail flounder, witch, Greenland halibut, and Atlantic halibut) and deepwater species (redfish and grenadiers) respectively. The sampling sections are responsible for collecting biological samples from the commercial fisheries conducted by Canada and foreign nations fishing in our waters. These samples may either be gathered from landings (port sampling) or at sea (observer program). The Fisheries Ecology section conducts research of a more cross-sectional, multi-disciplinary nature into many areas related to the species noted above.

2. Internal Review

The A/Division Head reviewed 18 of the 19 projects listed in the 1987 PRE report in consultation with the Section Heads. The 19th project, that of the Special Projects Section, was terminated along with the section in June, 1988, coincidental with the retirement of E. J. Sandeman, and was not reviewed during this exercise. Prior to review by the A/Division Head, all projects were reviewed by Section Heads in consultation with their scientific staff.

3. Division Highlights

- 1) Assessments of some 25 stocks presently under catch quota regulations were conducted and advice for the 1989 fishing season provided through either CAFSAC or NAFO. Further advice for cod in NAFO Div. 2J+3KL will be forthcoming in January, 1989.
- 2) Fourteen offshore cruises utilizing large research vessels were conducted: nine of these were to measure changes in resource abundance and to collect ancillary biological information. One was to the 2J3K area during the winter commercial cod fishery to estimate abundance of commercial concentrations. One was to study the factors affecting inshore migration of cod by locating cod in the offshore/nearshore area and studying their behaviour in relation to temperature, capelin abundance, and other environmental factors. One was to further investigate the use of hydroacoustics to estimate groundfish resources. One was to investigate the distribution and abundance of juvenile flatfish in the Grand Banks area with the aim of describing recruitment to the commercial fishery. One was to conduct gear trials using SCANMAR and an underwater vehicle to photograph net performance.

In addition, four inshore cruises were mounted on smaller research vessels: one to collect inshore samples from the commercial cod fishery in Labrador. One was to acoustically tag and track cod in the inshore 3L area. Two were to tag cod in 3L and 3Ps respectively.

- 3) Numerous biological samples were collected from the Canadian and foreign fisheries in the area. These were used in the assessments of the various stocks.
- 4) The results from the gear trials survey appear to be very informative. A seminar concerning these results will be given in the near future and interest has been expressed by both FFI and National Sea.
- 5) A lumpfish tagging program was initiated in 1988 with about 1000 being tagged. In addition, commercial sampling of the lumpfish fishery took place for the first time in 1988.
- 6) In conjunction with Statistics Branch, a sampling program was designed for the inshore cod fishery: to be implemented starting in 1989.
- 7) A "Temperature Directed Fishery Project" was initiated in order to assist the Atlantic Canada trawler fleets in utilizing physical oceanographic data in a co-ordinated way. A low-cost multi-ship computer network was installed, laying the infrastructure for many new developments in fishing strategy.
- 8) The contributions of R. Wells, C. Bishop, J. Baird, and H. Lear, all of the Gadoids Section, to the management of the cod resources off the coast of Newfoundland have been recognized at the highest levels. They will be receiving Merit awards for their work at a presentation in Ottawa in December.
- 9) International collaboration has been developed in the area of global ocean modelling.

10) Important strides have been made in the area of recruitment variability as it relates to temperature. A national Workshop on Recruitment was held at the Northwest Atlantic Fisheries Centre, February 23-25, 1988.

11) Although a low priority project, publications are forthcoming concerning roundnose grenadier. This will be useful in the future as client interests in underutilized species increases.

12) Dr. J. C. Rice, formerly Section Head - Fisheries Ecology, was appointed Division Head from December 1, 1988, replacing A. T. Pinhorn who had served as Groundfish Division Head for 14 years.

4. Expected Key Results

1989-92 (inclusive)

a) Assessments of some 25 stocks presently under catch quota regulations will be conducted and advice TAC's for the next year's fishing season will be provided.

b) Research cruises will be mounted to estimate biomass levels of various species and to document changes in biological parameters in response to biotic and abiotic factors.

1989

a) Acoustic studies of nearshore cod distribution relative to capelin densities and sea temperature will be initiated in the Newfoundland area as will acoustic studies of cod inshore catchability relative to oceanographic conditions.

b) Cod tagging will continue in order to define the discreteness of inshore stocks.

c) Year-class indices of juvenile yellowtail will be modeled for inclusion into yellowtail assessment.

d) Papers will be published on the age and growth of adult yellowtail, and juvenile plaice and yellowtail.

e) Paper on the distribution of roundnose and roughhead grenadiers in the northwest Atlantic will be published.

f) Document describing the biology of lumpfish in the Newfoundland area will be produced.

g) Seasonal variations in the distribution of redfish in 3L will be described.

h) Stability of biomass by size groups and taxa on the Grand Banks will be quantified.

i) Feeding of cod in the inshore and nearshore area off Cape Bonaville will be described.

1990

a) Paper will be published describing the factors which regulate gillnet catches of cod.

b) Data from acoustic tracking of cod will be analysed to better understand the fish' behaviour in the inshore area.

c) Paper will be published describing the distribution of juvenile plaice and yellowtail on the Grand Banks.

d) Analyses of comparative trawling and hydroacoustic work on redfish in Hermitage Bay will be documented.

e) Spatial and temporal source of cod caught inshore will be compared with results from Grand Banks.

f) More understanding of the effects of global climate change on fish stocks is expected.

g) Environmental correlates of variation in biomass by group and assemblage structure on the Grand Banks will be examined.

h) The relationship between the distribution of cod and its prey in 2J3K will be described.

1991

a) Results of acoustics/trawling surveys will be analysed to determine how water temperature in the nearshore area affects the movement of cod from deeper, warmer offshore waters to the shallow inshore water during early summer.

b) Papers will be published on growth and sexual maturity, and food and feeding of plaice and yellowtail on the Grand Banks.

c) Paper will be published on the infestation of redfish by Spirion lumpi.

d) Models relating environment and biological features will be developed.

PELAGIC FISH, SHELLFISH AND MARINE MAMMALS DIVISION

G. H. WINTERS

1. Introduction

The primary objective of the Pelagic Fish, Shellfish and Marine Mammals Research Division is to provide reliable real-time biological advice to national and international fisheries managers on the management of the commercially and potentially commercially important pelagic, shellfish and marine mammals species in the Newfoundland area. The ultimate aim of this advice is the maximization of social and economic benefits to Canada from these resources. In exercising this mandate, the Division utilizes 40 continuing full-time (C.F.T) employees. It is composed of four sections as follows:

Pelagic Fish Section - conducts research into the biology and population dynamics of pelagic fish (herring, capelin, mackerel, sand lance) (10 C.F.T.)

Shellfish Section - conducts research into the biology and population dynamics of shellfish (lobster, scallops, shrimp, crab, squid) (14 C.F.T.)

Marine Mammals Section - conducts research into the biology and population dynamics of marine mammals (harp and hooded seals, whales) (5 C.F.T.)

Fisheries Ecology Section - conducts multidisciplinary research on the ecological factors affecting the population dynamics of pelagic, shellfish and marine mammal populations (9 C.F.T.)

2. Internal Review

The review was conducted by the Division Head in consultation with the Section Heads.

3. Division Highlights

- 1) Assessments of some 17 stocks presently under quota regulation were conducted for advice on total allowable catch.
- 2) Eighteen cruises with research vessels were conducted: pelagic (5), crab (4), ichthyoplankton (3), scallops (2), squid (1), capelin tagging (2), and shrimp (1). In addition, fixed-wing aerial surveys were made of spawning capelin in inshore areas.
- 3) A full-scale acoustic survey, using a BIOSONICS dual-beam hydroacoustic system applied to a modified survey design, was successfully carried out in October-December 1988. Integrated counts and biomass estimates of herring from this survey will form the basis of 1989 assessments of herring stocks along eastern Newfoundland.
- 4) Analyses of reproductive data from snow crab populations have confirmed that sublegal males can replace larger males in mating activity in a heavily fished crab population.
- 5) Assessment of the St. Pierre Bank scallop population predicted removals of above 1000 MT of meats. Actual landings are within 5% of predicted levels.
- 6) A low to moderate level of inshore squid abundance was forecast for 1988. This has been consistent with realized landings for 1988.
- 7) A bottom trawl survey of crab biomass levels was successfully carried out in Conception Bay in April-May 1988. When used with molt prediction models, these surveys indicate considerable promise of being able to provide real time forecasts of abundance and yield levels.

4. Expected Key Results1989-92 (inclusive)

- a) Assessment of some 17 stocks presently under catch quota regulations will be conducted and advice on TACs for the next fishing season will be provided.

1989

- a) Initiate formal investigations into distribution and abundance of Iceland scallops on the Grand Banks of Newfoundland.
- b) Prediction of year-class strength of capelin from larval/environmental data.
- c) Develop and refine acoustic survey techniques for herring.
- d) Description of changes in Bonne Bay crab population.

C-1

FRESHWATER AND ANADROMOUS FISH DIVISION

T. R. Porter (Acting)

Introduction

The Freshwater and Anadromous Fish Division has two primary objectives: 1) to provide biological advice to regional, national and international fisheries managers on commercially and recreationally important freshwater and anadromous fishes in the Newfoundland Region; and 2) expand or restore Atlantic salmon stocks through salmon enhancement techniques and provide technical advice to the aquaculture industry. Biological advice to fisheries managers relates not only to stocks originating in Newfoundland-Labrador lakes and rivers, but also to Atlantic salmon originating in the rivers of other provinces and caught in commercial fisheries in Newfoundland and at West Greenland. The advice is aimed at supporting management of these resources to provide maximum social and economic benefits to Canada.

The freshwater and Anadromous Fish Division consists of the following two sections:

1. Salmon and Charr Section - performs research into the biology, population dynamics and production of Atlantic salmon and Arctic charr and provides advice on their management (12 CFT).
2. Enhancement and Aquaculture Section - implements salmonid enhancement projects, performs research, and develops new techniques to increase salmonid production (15 CFT).

An aquaculture coordinator-researcher was added to the Division and has been assigned to the Enhancement and Aquaculture Section. The aquaculture coordinator will provide scientific advice and support for technological transfer between DFO and the aquaculture industry on matters related to finfish and shellfish aquaculture in Newfoundland Region.

In conducting its assessment mandate, the Division relies on monitoring of upstream migrating salmon at fishways and temporary fish counting facilities, angling and commercial catch statistics, sampling of recreational and commercial fisheries and results of ongoing research activities in both freshwater and marine environments. With respect to salmon enhancement projects, the Division relies heavily on support from development associations and government agencies outside DFO.

Annual Review

A detailed review of each project was conducted by the Section Heads in consultation with the appropriate investigator. A general review of the 10 project submissions was conducted by the Acting Division Head.

Division Highlights

Division productivity in terms of publications included a total of 6 primary/interpretive publications, 11 scientific and technical, and 2 popular and miscellaneous articles.

Salmonid Assessment and ResearchOptimum spawning requirements and juvenile production studies

- 1) The juvenile salmon production research in the Trepassey area will be used in a National Habitat Evaluation Project. Habitat parameters being measured will be used in developing habitat evaluation models.
- 2) Funding from the Habitat Evaluation Project permitted additional electrofishing stations, in Freshwater River and Northeast Brook, to be included in the regular program. This resulted in new findings and a stronger data base from which to construct predictive models. It was found that large salmon parr occurred in high densities throughout the system, including second-order streams 4.2 km upstream from spawning areas. Previously it was not thought that juvenile salmon migrated long distances upstream. The young salmon have displaced brook trout from many types of habitat, including medium depth ("1 m) lakes. Salmon fry were abundant close to spawning grounds but, unlike previous years, were sparse downstream. Salmon fry are the most severely affected age class by changes in discharge. Cooperative work with Memorial University allowed population estimates to be made on an additional lake in Freshwater River. Approximately 300-2+ smolts were enumerated in an originally-designed smolt trap on Freshwater River.

Atlantic salmon assessments

- 1) A mark-recapture experiment was again carried out to estimate the smolt output from Conne River in 1988. The estimated number of smolts was 63,000. This is about 10,000 fewer smolts than estimated to have emigrated in 1987. For the second year in a row, a large number of salmon parr were counted moving downstream through the fish counting fence on Conne River, although relative abundance within the estuary in 1988 was lower than in 1987. Two fish tagged as parr in 1987 returned as adults in 1988 suggesting a possible summer or fall smoltification of fish in the estuary. There were 7118 small salmon and 418 large salmon counted migrating upstream in Conne River in 1988. This represents a decrease of 27% and 16% respectively from 1987. 251

PROJECT REPORT

EXPERIMENTAL SCIENCES DIVISION
 Habitat Research and Assessment Section
 HABITAT RESEARCH AND ASSESSMENT
 L. H. Bain (to August 15, 1988), R. N. McCubbin,
 M. A. Barnes, and D. A. Scruton

1. PROJECT DESCRIPTION

Research is conducted in support of the Department's Policy for the Management of Fish Habitat; formal and informal environmental assessments are participated in where fish habitat is threatened; and scientific and technical support is provided to Fisheries and Habitat Management Branch in their role as fish habitat managers.

2. RATIONALE/JUSTIFICATION

- (1) Assess the effects of human-induced chemical, physical and biological changes on fish and their habitats and determine appropriate mitigative strategies.
- (2) Refine our understanding of the factors that control the productive capacity of natural habitats.
- (3) Enhance the section's capability to provide fish habitat-related scientific expertise in the areas of environmental assessment, habitat management, and habitat restoration/development.
- (4) Contribute to the process of public information and education promoting the importance of fish habitats.

3. TIMEFRAME

Indeterminate.

4. PRIORITIES ADDRESSED

1.B.8.1; 1.B.14.5; 1.B.14.6.

5. EXPECTED KEY RESULTS (1989-92)

1989:

Introduce HEP (Habitat Evaluation Procedure) at the Seal Cove Brook diversion project to evaluate the method with respect to Newfoundland conditions and cost.

1990:

Produce a manuscript describing the results of monitoring the effectiveness of minimum flow release on resident salmonid populations of the West Salmon River.

1991:

Determine the effectiveness of fish habitat replacement in Seal Cove Brook (this result is dependent upon the construction schedule of the provincial Department of Transportation).

1992:

Evaluate the effectiveness of small scale habitat improvement projects being carried out on selected projects funded under the Inshore Fisheries ERDA sub-agreement.

6. GOALS/ACCOMPLISHMENTS IN PREVIOUS YEAR (1988)

- 1) Evaluate for a second year the spawning success of ouananiche in the West Salmon River under regulated flow (Data from 1987 are to be evaluated in the spring of 1988 in order to assess the merits of collecting a second year's data.)

A second year of data was collected at eight experimental and six control sites. Data will be evaluated to determine spawning success, habitat protection, etc. under regulated flow conditions. Baseline data (from BEAK) and one additional year of regulated flow data (from LGL) will be incorporated into the study. (Scruton)

- 2) Evaluate the impacts of road construction, culvert placement and stream alignment in South Brook, Waterford River, in connection with the Commonwealth Avenue Extension and interchange (baseline data collected in 1987).

The first year of post construction data was collected in the summer of 1988 (9 sites). Additional years of data will be collected to evaluate the stabilization and recolonization of habitat after culvert placement and road construction. (Scruton)

PROJECT REPORT

EXPERIMENTAL SCIENCES DIVISION
Habitat Research and Assessment Section
ACID PRECIPITATION STUDIES
P. M. Ryan and D. A. Scruton

1. PROJECT DESCRIPTION

Acid precipitation research in the Newfoundland Region involves the inventory of selected lakes in Newfoundland to determine their sensitivity (and that of resident fish populations) to acid rain based on their present chemical status, surrounding geology and current acid deposition rates. A number of Atlantic salmon rivers are monitored to determine seasonal variability in water quality and maximum pH depressions. Acid sensitive lake and river systems and resident biota are monitored seasonally to detect impacts of acidification (long-term or episodic). Planktonic fossils in lake sediments are examined for historical evidence of lake acidification.

The collection and evaluation of chemical, physical, and biological data from lakes and rivers in Newfoundland are used to determine sensitivity and present status in relation to acid deposition. A long-term monitoring program on lakes and rivers in insular Newfoundland, including sampling of chemistry, benthos, plankton, and fish is used to focus on seasonal dynamics and episodic problems. Selected systems are monitored during peaks in the hydrological cycle to document timing, extent and duration of episodic acidification. Planktonic assemblages (both zoo- and phyto-) in lakes are evaluated in relation to morphometry and chemistry to determine plankton communities in relation to acid precipitation and to define a baseline for future studies. Benthic production in streams in relation to water chemistry (acidity) is investigated to evaluate acid rain effects on non-fish biota in lotic systems. Paleocological techniques are used to examine lake sediments for historical (fossil) evidence of changes in water quality over time.

*Mr. D. A. Scruton was transferred to Habitat Research and Assessment project effective April 1, 1987.

2. RATIONALE/JUSTIFICATION

The general aims of this project are the determination of the susceptibility of insular Newfoundland and Labrador freshwaters and associated fisheries resources to the Long Range Transport of Atmospheric Pollutants (LRTAP) and the impact of acid rain on these resources. This project is carried out as part of the national LRTAP program.

3. TIMEFRAME

Indeterminate (depending on funding beyond March 1990). There is currently a new LRTAP submission being prepared for consideration by the appropriate authorities.

4. PRIORITIES ADDRESSED

1.B.8.2.

5. EXPECTED KEY RESULTS (1989-90)

1989:

Publications on results of previous research.
Synthesis of Newfoundland LRTAP work for national compilation and review.

1990:

The current funding for acid precipitation studies is due to expire March 31, 1990. Expected key results after 1989/90 will be dependent on the extent of LRTAP V funding.

6. GOALS/ACCOMPLISHMENTS IN PREVIOUS YEAR (1988)

P. M. Ryan

- 1) Input to revision of protocols for DFO national biological monitoring studies in consultation with the national DFO biological monitoring working group. Revisions are to be based on results of 1987 monitoring and incorporated into 1988 monitoring studies.

Protocols are being revised to include the monitoring of additional trophic levels. Protocols were reviewed at two workshops (on zooplankton and U.S. protocols) and two meetings of the DFO national biomonitoring working group. Revisions will continue as decided by the biomonitoring working group.

- 2) Conduct, via contract, biological monitoring studies on three Newfoundland river systems. Monitoring will consist of documenting the kinds and relative abundance of fish, benthic invertebrates, and plankton and recording associated water quality.

PROJECT REPORT

EXPERIMENTAL SCIENCES DIVISION
Fish Health and Parasitology Section
DISEASE RESEARCH
D. H. Shaw and J. H. Banoub

1. PROJECT DESCRIPTION

Definition of the part played by lipopolysaccharides from fish pathogens in infection and protection of salmonid fish. Methods used will determine the structure of the immunodeterminant portion(s) of endotoxins from Aeromonas, Vibrio and Yersinia species and relate this to the serological characteristics of the same bacteria using antisera from both rabbits and rainbow trout. This knowledge will be used to develop and test semi-synthetic antigens with similar immunochemical properties and possible protective characteristics. The project also includes inter alia diagnosis of bacterial diseases of fish and general attention to problems of fish health in the Newfoundland Region.

2. RATIONALE/JUSTIFICATION

The objective is to develop an understanding of the interaction of fish pathogens with the defence mechanism of the fish; to explain the general lack of success of fish vaccines and eventually to move in the direction of isolating fractions from the bacterial cell which offer protection to the fish against the bacteria. A further objective is to understand the distribution of disease in Newfoundland and to offer advice on the movement of fish within and without the province.

3. TIMEFRAME

Indeterminate.

4. PRIORITIES ADDRESSED

1.A.4.1; 1.B.7.1.

5. EXPECTED KEY RESULTS (1989-92)

1989:

Vaccinate rainbow trout with synthetic antigen to Vibrio anguillarum.
Complete structural investigation of V. anguillarum lps.

1990:

Begin to investigate the biological effects of lps on fish, particularly on blood parameters, and define the differences in mammalian and piscine responses.

1991:

If work to this point has been successful, begin a concerted effort to transfer the technology to the aquaculture industry and the private sector.

1992:

Complete and publish structural investigation on Y. ruckerii lps.

6. GOALS/ACCOMPLISHMENTS IN PREVIOUS YEAR (1988)

- 1) Continue investigation on the structure of Y. ruckerii SJ-104. For this year emphasis on the structure of the O-antigen and lipid A. (Shaw)

This has progressed extremely well using high performance nmr technology (with Max-Planck Institut). The proposed O-antigen structure is probably correct but needs further proof. In the process the scientist involved has gained excellent experience in using 2D nmr on a modern instrument.

- 2) Develop the ability to use ELISA as an analytical tool for the presence of specified antigens in the serum of infected fish. (Shaw)

Not done for reasons given below. This will not be carried over to 1989 due to more pressing research needs.

- 3) Continue structural work of the O-specific polysaccharide of the lps of Yersinia ruckerii Strain SJ-103, focusing on the complete identification of the novel dideoxy-amino sugar. (Banoub)

Structural studies were carried out on the O-specific polysaccharide isolated from the lipopolysaccharide of the virulent strain Yersinia ruckerii strain 103, the causative agent of enteric red-mouth disease. Two new spectroscopic techniques were used, namely Pyrolysis-direct chemical

PROJECT REPORT

OCEANOGRAPHY, HYDROGRAPHY AND TOXICOLOGY DIVISION
 Toxicology Section
 TOXICOLOGY AND CONTAMINANTS
 J. F. Payne, J. W. Kiceniuk, L. L. Fancey,
 J. Hellou, S. Ray (from December 19, 1988),
 J. Morgan (Visiting Fellow - from September, 1987
 to November, 1988)

1. PROJECT DESCRIPTION

Project involves the application of biochemical, physiological, chemical and ecological concepts to evaluate aquatic environmental concerns of specific interest to the Newfoundland Region in particular and Atlantic Canada in general.

Emphasis is placed on field validation of laboratory developed biological monitoring and assessment procedures. The approach is multidisciplinary and oriented towards interpretation of multiple variables.

For the purpose of provision of advice, a special emphasis is placed on keeping abreast of a diverse array of chemical issues of regional, national and international concern.

2. RATIONALE/JUSTIFICATION

To provide basic and mission oriented research on aquatic organisms in their natural and man altered environments and develop methods for monitoring the biological effects of such perturbations of the aquatic environment. Act as base of expertise in the Region for providing advice on toxicological issues.

This requires a number of approaches:

- a) Elucidation of sublethal pollutant effects/presently emphasizing petroleum hydrocarbons and drilling fluids.
 Development of practical biological monitoring indices/presently emphasizing petroleum hydrocarbons drilling fluids and polycyclic aromatic hydrocarbons.
 Elucidation of the fundamental mechanisms of toxicity of the complex mixture of hydrocarbons found in petroleum.
- d) Provision of expert advice to fisheries managers on a variety of toxic chemical issues of regional or national concern.
- e) Monitoring of contaminants in fish and aquatic ecosystems.

3. TIMEFRAME

Indeterminate.

4. PRIORITIES ADDRESSED

1.B.14.1; 1.B.14.7.

5. EXPECTED KEY RESULTS (1989-92)

1989:

Initiate first year of PERD-sponsored research on effects of oil-based drilling muds upon larval capelin.
 Produce a statement concerning impact zones for fish around petroleum hydrocarbon development sites.
 Produce a statement on the scope of any potential toxicological problems in Placentia Bay.

1990:

Produce a summary statement on the relationship between levels of aromatic hydrocarbons in sediments and the effect on various fish species in the marine and freshwater environment.
 Establish whether freshwater fish species in Newfoundland have any significant levels of polycyclic aromatic hydrocarbons from LRTAP sources.
 Provide preliminary information on the levels of hydrocarbons found in seals in the Newfoundland/Labrador area.

1991:

Produce a statement on the potential for carcinogenesis of fish in inshore Newfoundland waters.
 Provide more definitive information on the levels of hydrocarbons found in marine mammals in the Newfoundland/Labrador area.
 Associate studies on hydrocarbon levels found in fish in the Hibernia area.

1992:

Provide preliminary information on the levels of hydrocarbons found in various fish species in the Hibernia area.



Fisheries
and Oceans

Ocean Science and
Surveys Atlantic

Pêches
et Océans

Sciences et levés
océaniques Atlantique

Telex 01931552

Your file Votre référence

Our file Notre référence

October 23, 1989

Mr. George Sheehy
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy

This is in response to your letter of September 29 to Mr. S. B. MacPhee, Regional Director, Science, DFO Scotia-Fundy Region on environmental indicators. Completed forms are enclosed in respect of this Region. You will note that in several cases extracts from our "Project Review, Evaluation, and Planning 1988/89" document are enclosed in lieu of forms; it is assumed that in these cases you can extract the relevant information.

Yours sincerely,

H. B. Nicholls, Head
Marine Assessment & Liaison Division

Att.

HBN/wg

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: J.A. Elliott Telephone: 426 8478
Title: DIRECTOR, Physical & Chemical Sciences Branch
Address: Bedford Institute of Oceanography
Dartmouth, N.S. B2Y 4A2

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Long-range and applied research in physical and chemical processes along east coast marine environment. Major programs are in Ocean Climate & Services, Marine Engineering and Offshore Development Services, Living Resources, Biogeochemistry and Toxicology, Habitat & Contaminants.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Marine Chemistry Division

Project objective(s)

The determination of inorganic and organic chemical distributions in the marine (coastal and open ocean) environment, their phase transfers, transformation and the mechanisms of transport, and accumulation and fate.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

From Halifax Harbour, to Scotian shelf, Arctic, North

Atlantic & Global.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK
SURVEY QUESTIONS

Your Name: Dr. R.H. Cook Telephone: (506) 529-4517
Title: Chief, Aquaculture and Invertebrate Fisheries Division
Address: Department of Fisheries and Oceans
Biological Station
St. Andrews, N.B. EOG 2X0

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

- Invertebrate fisheries assessments in Bay of Fundy area - to provide advice to resource managers for lobster, scallops and soft-shell clams.

- Impacts of aquaculture on fish habitat - to make recommendations to federal and provincial administrators of the aquaculture industry.

- Acid rain research - to provide scientific database on the effects of acid rain on freshwater fisheries of the Maritimes.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

See other DFO submissions.

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Cape Breton Crab assessment
and research

Project objective(s)

Assess present and potential
production of commercial crabs and
conduct research on all aspects of the
life history, ecology. Commercial crabs
relevant to understanding natural and
man-induced fluctuations in stock size.
Project leader M. R. Elner

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Scotia - Fundy Region

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

LOBSTER STOCK ASSESSMENT

(project leader: P. Lawton)

Project objective(s)

- to assess lobster stocks in 3 areas within the Bay of Fundy. The data is used in generating biological advice for input into the fishery management process.

Geographic scope (circle one)

global

national

③ regional

local

If regional or local, what is the geographic area covered?
principally Bay of Fundy area

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

LOBSTER RESEARCH: JUVENILE AND ADULT FIELD STUDIES

(project leader: P. Lawton)

Project objective(s)

- to examine the recruitment process in the Bay of Fundy lobster population. Ultimate goals of this research are the identification of factors limiting lobster nursery area productivity, and the development of an index of pre-recruit abundance.

Geographic scope (circle one)

global

national

③ regional

local

If regional or local, what is the geographic area covered?

principally Bay of Fundy area

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Lobster assessment and
related research

Project objective(s)

To provide the best possible biologic
advice on which to base some lobster
management and to carry out that research
deemed most important to improve that
advice

Project leader Dr. R. Miller

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Scotia - Fundy Region

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

GREY AND HARBOUR SEAL ASSESSMENT AND ECOLOGY

Project objective(s)

- 1) to determine trends in population size
- 2) to determine the nature of the ecological interaction between seals and fisheries
- 3) to determine the role of seals in the transmission of the sealworm parasite
- 4) to provide biological advice on the management of grey and harbour seals

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

Scotian Shelf; Bay of Fundy; Gulf of Maine

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

FISH STOCK ASSESSMENT AND ECOLOGY

Project objective(s)

- 1) to determine trends in population size and sustainable harvest levels
- 2) to understand to influence of fishing and ecological factors on fish abundance and distribution
- 3) to provide biological advice on management of marine fishes

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?
Scotian Shelf; Bay of Fundy; Gulf of Maine

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Scallop assessment and research

Project objective(s)

To provide sound biological advice on the various scallop fisheries and to conduct the research deemed most likely to improve this advice

Project leader Dr. G. Robert

Geographic scope (circle one)

global

national

☒ regional

local

If regional or local, what is the geographic area covered?

Scotia-Fundy Region

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

SOFT-SHELL CLAM ECOLOGY AND FISHERY RESEARCH

(project leader: S.M.C. Robinson)

Project objective(s)

- to obtain pertinent biological baseline
information on the clam populations in
the Scotia-Fundy region in order to make informed decisions with
regard to pending management measures on the industry.

Geographic scope (circle one)

global

national

③ regional

local

If regional or local, what is the geographic area covered?
principally Bay of Fundy area

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

SCALLOP POPULATION DYNAMICS AND FISHERY RESEARCH

(project leader: S.M.C. Robinson)

Project objective(s)

- to annually assess sea scallop populations in the Scotia-Fundy region and to investigate the population dynamics of scallops in order to understand population fluctuations for prediction of recruitment patterns.

Geographic scope (circle one)

global

national

③ regional

local

If regional or local, what is the geographic area covered?

principally Bay of Fundy area

INDICATOR RESEARCH PROJECT DESCRIPTION

Project #49

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Offshore clam assessment
and research

Project objective(s)

To provide biological advice
on Scotian Shelf clam stocks, and
carry out the research deemed most
likely to improve this research

Project leader Mr. D. Roddick

Geographic scope (circle one)

global

national

③ regional

local

If regional or local, what is the geographic area covered?

Scotia - Fundy Region

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

IMPACTS OF ACID RAIN ON SALMONID ECOLOGY

(project leader: G.L. Lacroix)

Project objective(s)

- to examine the effects of acidification

on freshwater on Atlantic salmon and other fish and on their habitat in rivers of Atlantic salmon. Specific objectives are to determine the ecological and physiological responses of these fish to toxic factors in acidified rivers and to changes in water chemistry over time.

Geographic scope (circle one)

global

national

☒ regional

local

If regional or local, what is the geographic area covered?
principally Bay of Fundy area

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ☒ 1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Carbon Dioxide and Climate
Biogeochemical Cycles in the Ocean

Project objective(s)

Examine the role of the
oceanic biota as a possible sink for a
significant fraction of the increased
atmospheric CO₂. It is relevant to the
course of the Joint Global Ocean Flux Study
(JGOFS) an international research project for which
this project is one of Canada's major contributions

Geographic scope (circle one)

☒ global

national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

EFFECTS OF LOW pH ON SALMONID DEVELOPMENT

(project leader: R.H. Peterson)

Project objective(s)

- to determine the ways by which low pH affects the early life stages of Atlantic salmon. Processes such as fertilization, water hardening, hatching, embryonic movements, alevin ion exchange, and yolk utilization are investigated at various levels of acidity.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?
principally Bay of Fundy area

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

*Marine plant assessment and
research*

Project objective(s)

*To understand the relationship
between legal productivity and major
biotic and abiotic state variables*

Project leader Mr. G. Sharp

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

Scoti-Furley Region

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

AQUACULTURE ECOLOGY RESEARCH

(project leader: D.J. Wildish)

Project objective(s)

- to devise efficient techniques to determine the extent and biological implications of habitat changes caused by the development of mariculture, including the effect of nutrient enrichment on stimulating red-tide blooms and to understand the physical environmental and biological factors influencing the production of commercially valuable bivalve mollusc species.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

principally Bay of Fundy area

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 706

Project Title: Inshore Clam Stock Assessment and Related Research

Project Leader: T.W. Rowell

Other Researchers: P. Woo

1. Project Description:

This project involves basic biological and stock assessment research necessary for the management of the soft-shell clam fishery. Advice is provided to both CAFSAC and DFO managers and to advisory committees involving both industry and DFO representatives.

2. Long-Term Objectives:

Monitor soft-shell clam resources and their habitat and maximize continuing biological production from stocks with commercial or recreational potential; expand and rehabilitate these stocks where economically justifiable and technically feasible; expand the molluscan shellfishery base through identification of underdeveloped or underutilized resources where new harvesting or utilization techniques may apply; develop a scientific information base for future sound management of these resources; develop new research methods and techniques to facilitate and improve the efficiency of current monitoring and stock assessment procedures.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Provide biological advice on the inshore clam fishery.

Biological advice was provided to several area Soft-Shell Clam Advisory Committees throughout the year as well as to the Scotia-Fundy Regional Shellfish Committee and to the Soft-Shell Clam Workshop II held in Saint John, N.B.

2. Design and cost a long-term sampling scheme for the major inshore clam stocks.

This goal was addressed under the Clam Enhancement Project as reported under Project #707 (Inshore Molluscan Habitat Studies). As well as being designed and costed, the scheme was fully implemented.

3. Develop a cost-effective means of monitoring catch and effort in the Annapolis Basin and Five Islands/Economy soft-shell clam fisheries.

This goal was also addressed and greatly expanded under the Clam Enhancement Project. A highly effective fishery monitoring and biological sampling scheme was put in place for all the major clam producing areas of the Scotia-Fundy Region.

4. Develop and evaluate methods for enhancing soft-shell clam productivity and expansion of the fishery, dependent on the availability of funding under the Atlantic Fisheries Development Program.

The Clam Enhancement Project, while addressing goals 2) and 3) above, also has a major component aimed at i) evaluation of both the negative and possible positive impacts of current harvesting practice and ii) evaluation of possible enhancement techniques. A cost-shared project between DFO and Dalhousie University (Jon Grant), in which several undergraduates and one Ph.D. student are involved, has resulted in the conduct of a number of experiments on the impact of digging practice and clam burial in various bottom substrates. Additionally, field trials of commercially practical (operationally) approaches to enhancement have been designed for implementation by Area Clam Associations.

4. Additional Accomplishments:

Development and implementation of a soft-shell clam harvester's log for use by representative diggers in all major clam producing areas.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 714

Project Title: Application of Acoustics to Habitat Management

Project Leader: P. Boudreau

Other Researchers: S. Kerr

1. Project Description:

Application of acoustic methods for evaluating levels of fish biomass and average size in marine and freshwater habitats.

2. Long-Term Objectives:

To provide information on the distribution and abundance of fish populations in both marine and freshwater habitats which can be used a) to assess habitat production and b) and to estimate fish biomass levels for particular habitats.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

Goals and outputs carried over from Project 123, Marine Fish Division.

1. Carry on with trial acoustic cruises to supplement and improve existing survey methodology and prepare cruise reports and working paper. (Dickie, Boudreau and Dowd)

Two sea trips were completed using the ECOLOG I acoustic system. In late March/early April acoustic data on haddock distribution around Browns Bank were collected. In June acoustics were used during a joint acoustic/rawl survey for pollock on the eastern Scotian Shelf. I have been advising Marine Fish Division during the analysis of the data. I supervised the deployment on the ECOLOG II acoustic system in Resolute Bay in conjunction with Seastar UP for the development of acoustic survey methodology. Equipment failures prevented the collection of quantitative data.

2. Develop procedures for reporting acoustic information as abundance estimates for assessments and prepare working documents. (Dickie and Boudreau).

Preliminary analysis was completed on the data from the 1987 pollock cruise on the southern Scotian Shelf. The results, in the form of numerical abundance estimates, were presented to two groups, CAFSAC SSS Subcommittee and the FAST Working Group of ICES in Ostend, Belgium.

4. Additional Accomplishments:

A paper has been prepared which used acoustic information to study meso-scale distribution of haddock over a 24 hour period. This work shows that there is a relation between fish biomass and average fish size which has been observed for other fish species in other habitats. The work supports the use of acoustic information in the studying organism spacing, within their habitats, on scales which are not available to other types of sampling.

5. Goals/Expected Outputs for 1989:

1. Analysis of acoustic records of fish abundance which were collected on a 1985 Hudson cruise designed to sample all of the various components of the Labrador Shelf ecosystem. (Boudreau).
2. Conduct an acoustic survey on the Southern Scotian Shelf. The cruise will be used to verify the processing of the ECOLOG II system and to collect data on haddock distributions. (Boudreau).

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Project No.: 213

Division: Habitat Ecology Division

Project Title: Bioenergetics of Marine Mammals

Project Leader: P.F. Brodie

Other Researchers:

1. Project Description:

Conduct research on the morphology, physiology, mechanics, feeding, and population energetics of marine mammals in the North Atlantic and along the east coast of Canada, with emphasis on the baleen whales. Knowledge gained from these studies is applied to a variety of scientific and operational problems including zooplankton sampling design, fishing gear design and operation, contaminant (DDT and PCBs) accumulation in seal populations and habitat alteration.

2. Long-Term Objectives:

Provide improved understanding of the trophic status of marine mammals, on both a local and world scale. Use baleen whales as indicators of marine production and compare estimates with those obtained using traditional sampling methods. Provide improved understanding of the habitat requirements of marine mammals and the potential impacts of environmental disturbances. Provide sound scientific advice on management issues concerning marine mammals.

. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Continue field studies of large whales at the Iceland facility and at the Marine Research Institute

Post mortem measurements of the mechanical energy stored in elastic fibres of baleen whale jaw mechanisms were made using load cells in the 2.5 ton capacity. Data from this study will be used in conjunction with other biomechanic studies conducted in Iceland to understand the dynamics of the world's largest natural harvester of marine production.

2. Complete a large manuscript for publication on cetacean respiration dynamics.

Still in preparation.

3. Complete a manuscript on the adaptive significance of grey and harbour seal temperature stratification.

Still in preparation.

4. Continue studies of cetacean propulsion in collaboration with Duke University.

Extensive studies with Duke University colleagues of the propulsive mechanics and stored energy mechanisms of large whales confirmed earlier published estimates of baleen whale propulsive efficiency which were based upon lipid consumption.

5. Serve as chairman of CAFSAC Marine Mammals Subcommittee and participate in AFSAC, COSEWIC, IUCN Seal Specialist Group, and ICES Working Group on Seals of the Greenland Sea.

Completed.

. Additional Accomplishments:

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 100

Project Title: Fish Habitat Assessment Advice

Project Leader: D.C. Gordon

Other Researchers: All Division Staff

1. Project Description:

Provide biological scientific advice on freshwater, estuarine and marine habitat issues as requested by DFO clients, in particular the Fish Habitat Management Branch.

2. Long-term Objectives:

Contribute to Science-sector support of the DFO Fish Habitat Management Policy which calls for maintenance of current habitat productive capacity, restoration of damaged habitats, and habitat development.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

Serve on habitat committees and provide biological habitat advice as requested (all staff).

Served on eight regional, three zonal, six national and eleven international habitat-related committees; reviewed eleven habitat documents for Science, Fish Habitat Management Branch, Inspection, Gulf Region and DOE; prepared two documents for habitat issues; responded to more than 12 information requests from Science, Fish Habitat Management Branch, Coast Guard, DND, newspapers and consultants; provided field assistance on two occasions to Fish Habitat Management Branch and DND; attended over 50 meetings or workshops dealing with habitat issues; presented over seven habitat science lectures to Science, Fish Habitat Management Branch, the US National Academy of Science, oil industry and the general public.

Major habitat issues addressed included: Long Range Transport of Atmospheric Pollutants (Hargrave, Harding, Keizer, Gordon); Georges Bank Hydrocarbon Exploration/Development (Gordon); Annapolis Basin clam mortality (Rowell, Peer); NB/PEI fixed transportation link (Hargrave, Peer, Messieh); Halifax Harbour cleanup (Hargrave, Peer); Shellfish toxins (Stewart, Rao).

4. Additional Accomplishments:

Helped establish a seminar series to inform Fish Habitat Management Branch staff on recent developments in habitat science. (Gordon)

5. Goals/Expected Outputs for 1989:

Serve on habitat-oriented committees and provide biological habitat advice as requested. (all staff)

6. Background:

Selected Involvements:

1. Collaborative Research -

Collaboration with numerous scientists in other divisions; H.B. Nicholls and staff in the Marine Assessment and Liaison Division; A. Ducharme and staff in the Fisheries and Habitat Management Branch.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 709

Project Title: Zooplankton Habitat Studies

Project Leader: G.C. Harding

Other Researchers: W.P. Vass, R.E. Reimer

1. Project Description:

Study the effects of natural and anthropogenic changes on the marine pelagic community, which includes long and short-term vagrancies of the 'weather', alteration of fresh-water input, contamination with pollutants, alteration of geochemical cycles and excessive fishing.

2. Long-Term Objectives:

Undertake scientific research to provide information and advice for management of our marine habitat.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

Accomplishments in 1988 focussed on lobster larvae studies which are reported under the Benthic Fisheries and Aquaculture Division's Project 212.

4. Additional Accomplishments:

1. Statistical analysis and preparation of a manuscript on the food-chain accumulation in the Gulf of St. Lawrence has progressed well and should be ready for submission next year. (Harding)
2. A seasonal study of organochlorine contaminants in plankton, seawater and rainwater in the southern Gulf of St. Lawrence has been successfully completed. The rainwater and seawater have been analyzed under contract while the plankton is presently being analyzed (LRTAP funds). Herring and gaspereau were also collected for organochlorine determination and comparison with measured levels in the same region 10 years ago. (Harding, Vass, and Hargrave)

5. Goals/Expected Outputs for 1989:

1. Mount a joint physical/biological cruise to Georges Bank to study the dispersal and retention of lobster larvae near the northern face of the bank in cooperation with the Benthic Fisheries and Aquaculture and Coastal Oceanography Divisions (PCS). (Harding)
2. Write a manuscript on the food-chain magnification of PCB's in the southern Gulf of St. Lawrence (Harding, Vass).
3. Design and field test an improved version of our plankton trap for future vertical flux studies (Vass Harding).
4. Develop an improved net-minder for BIONESS and Tucker trawls which will incorporate light and fluorescence as well as the present temperature, conductivity, depth and net characteristics, such as water flow inside and outside the net, tripping events, pitch and yaw (Reimer and Vass).
5. Lipid analyses and the development of a condition index for lobster larvae (Harding and Fraser).
6. Analyze remaining samples collected during the Labrador Shelf study of 1985 by contract. (Harding)
7. Analyze samples collected in the 1988 Georges Bank frontal study. (Harding)
8. Begin designing a new field program focusing on coastal zone habitat issues. (Harding)

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 719

Project Title: Contaminant Fluxes in Marine Food Webs

Project Leader: B.T. Hargrave

Other Researchers: G. Phillips

1. Project Description:

Consider the impact of chemical contaminants, physical disturbance and temperature changes on marine benthic systems.

2. Long-Term Objectives:

Develop monitoring techniques which quantify the impact of chemical contaminants, physical disturbance and temperature changes on benthic community and species functions and metabolic activities.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

The goals specified for this project in 1987, then titled Contaminant Fluxes in Arctic Ocean Food Webs, have been transferred to Project 720 which was created during 1988 after LRTAP funding was received. Accomplishments related to the new theme of this project during 1988 are: Initiated a study in August 1988 of sediments in Halifax Harbour and Bedford Basin. Grab samples were collected at 131 sites and are currently being analyzed for heavy metals by D. Buckley (AGC).

4. Additional Accomplishments

Participated in ad hoc scientific advisory group established at BIO to provide information and advice on impacts of sewage discharge in Halifax Inlet.

5. Goals/Expected Outputs for 1989:

1. Complete analysis of grab samples collected from Halifax Harbour and Bedford Basin in 1988 (organic carbon, nitrogen and bacterial numbers). Map metal contaminant distributions.
2. Initiate new study, if funded by Ocean Dumping Program, to measure fluxes of dissolved metals between sediments and seawater using benthic chamber.
3. Develop a new technique to assess rates of metabolic degradation of organic matter by aerobic/anaerobic decomposition and apply to sediments collected in 1988 from Halifax Harbour and Bedford Basin.
4. Conduct cooperative investigations with C. Schafer (AGC) of the temperature response of colonizing benthic fauna in artificial substrate exposed in Bedford Basin. The experiment will address the question - What is the impact of a +2.5°C rise in mean annual bottom temperature on the character of indigenous foraminifera populations inhabiting the depth interval exposed to the "seasonal" watermass layer? One set of colonization trays containing shed sterile sand will be held at ambient temperature while a second set will be artificially heated to +2.5°C. The effects of the elevated temperature on microbial and microfaunal colonization will be examined. The project is due to start in late summer 1989 with bimonthly sampling for one year. All expenses for the in situ exposure of heated and central substrates will be covered by AGC.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 720

Project Title: LRTAP Organic Studies

Project Leader: B.T. Hargrave

Other Researchers: G. Phillips, P. Vass, G. Harding

1. Project Description:

Quantify the long range atmospheric transport of organochlorine contaminants to food webs in the Arctic Ocean using Canada's Ice Island as a sampling platform.

2. Long-Term Objectives:

Provide baseline measurements of major semi-volatile organics (pesticides, PCBs) in the Canadian high Arctic Ocean environment by sampling air (vapor and particulate phases), snow, ice and seawater (dissolved and particulate phases), plankton, benthos, fish and sediments using Canada's Ice Island as a sampling platform. Assess the relative importance of atmospheric vs oceanic input of these contaminants to the Arctic Ocean by seasonal measurements. Evaluate the bioconcentration of these compounds for comparison with data from more southern latitude ocean sites to assess input of organochlorines to food webs utilized as food by native populations.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

Last year these goals were included under Project 221 (now 719), then entitled Contaminant Fluxes in Arctic Ocean Food Webs.

1. Initiate construction of a multi-cup (16) sediment trap for deployment under Ice Island to collect deposited particulate matter over a 12-month period. (Hargrave)

A 16-cup trap was constructed by Systems Engineering Group during the summer of 1988. Field trials, planned for October were not possible due to malfunction of the motor driven unit. This was repaired and is currently being modified to allow use of the motor in a new pressure case. (Hargrave)

2. Analyze samples collected in 1987 for dry weight, organic carbon, and nitrogen. (Phillips)

The work was completed on schedule. Macrozooplankton were separated from detritus and microlipid determinations were carried out on groups of similar species and development stages and a primary publication was submitted and accepted by Polar Biology.

3. Complete the unsolicited proposal - funded project, to prepare a final report for publication, and a manuscript summarizing all data collected during the three trips to the Ice Island.

Final report completed by March 1988. It was prepared for publication as a DFO Technical Report.

4. If funds are available, sampling will continue for volatile organic pesticides and PCB's in air, snow, seawater, plankton, benthos, and sediments under the Ice Island. (Hargrave)

Funding for Ice Island sampling was provided from A-Base and LRTAP sources. Field work carried out during late June and early July allowed surface melt-water to be collected. This was processed using XAD-2 columns. Seastar in situ samplers were also deployed to deeper depths (300-450 m) than was possible in 1986/87.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 141

Project Title: Benthic/Pelagic Exchanges

Project Leader: P.D. Keizer

Other Researchers: B.T. Hargrave, D.K. Muschenheim, P.J. Cranford, T.W. Rowell, D. Peer

1. Project Description:

Determine the distribution and exchange dynamics of inorganic nutrients, organic matter, and contaminants between sediment and water. Flocculated aggregates of organic and inorganic detrital particles are an important mechanism in the transfer of food materials to the benthos as well as a potential pathway for transfer of anthropogenic pollutants. Recent work (K. Muschenheim, Ph.D. thesis, Dalhousie University) has shown that "flocs" are themselves a food source of great importance to suspension-feeding marine organisms. This project focusses on the formation, vertical distribution, and shear strength of flocculated aggregates in the near-bed region of the benthic boundary layer. It also looks at the role of sea scallops Placopecten magellanicus in benthic/pelagic energy exchanges.

2. Long-Term Objectives:

1. Assess the role of the microbiota in floc formation and resistance to shearing forces, and examine time scales for floc growth and strengthening; relate cycle of floc formation and break-up to horizontal and vertical transport of organic detrital material in the estuarine environment; conduct investigations of the vertical distribution of organic detritus in the near-bed region and relate this to the horizontal transport (flux) of seston in the benthic boundary layer; and model and evaluate the potential impacts of benthic fluxes on the biological productivity; and further develop and refine new sampling tools (e.g. BOSS) for the study of suspended particle fields in the near-bed region.
2. Determine the role of sea scallops in the utilization of primary production from the water column; develop an energy budget for benthic/pelagic exchanges involving sea scallops and the meio-microfauna community on Georges Bank; and, assess the potential of living and non-living food resources in the nutrition of sea scallops.
3. Determine the importance of non-living organic matter to the nutrition of other key marine species and ensure that non-living organic matter pools (dissolved vs particulate; pelagic vs benthic; labile vs refractory) are accurately represented in ecosystem models developed for habitat or stock assessment purposes.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Modify and improve the BOSS device, including adaptation to accept a bank of Seastar submersible pumps for continuous sampling, and produce a Technical Report on its design, construction, and application.

The original BOSS frame was modified and strengthened in the Mechanical Development Shop (B.I.O.), taking advantage of knowledge gained during two test deployments in the Bay of Fundy. A completely new frame, for offshore and high current regime sampling, was designed by Don Knox and built by Jon Conrod. Either frame will accept the original syringe sampling bank or the new Seastar pump mounting carriage, which was recently completed. Detailed drawings of the BOSS are in preparation for a Tech. Rept.

2. Use the modified BOSS to sample polycyclic aromatic hydrocarbons (PAH) in the benthic boundary layer to assess bioavailability of PAH to benthic suspension feeders. This is the first year of a proposed three-year project.

See separate project report on the bioavailability of contaminants.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 715

Project Title: Size-dependent and bioenergetic processes in fish production habitats

Project Leader: S. Kerr

Other Researchers: W. Silvert, P. Boudreau

1. Project Description:

Evaluation of the effects of environmental factors and habitat change on fish habitat productivity.

2. Long-Term Objectives:

Develop procedures for evaluating and predicting the interaction of habitat variables with the production capacities of fish stocks and communities.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Carry out medium term research on alternative procedures for fish growth forecasting and analysis. (Kerr)

The principle accomplishment this year was in preparing a major submission through the OPEN program to acquire substantially increased resources to apply to this work. If successful, the resources will permit initiatives not currently possible.

2. Comparative analysis of size-structures of research trawl survey data. Production of size-composition analyses of Scotian Shelf data for comparison with Pope's summaries. (Kerr, Silvert)

Further discussions with staff from Lowestoft confirmed that there is value and general interest in continuing this work, but it is unlikely that HED staff will be able to participate with the limited resources at their disposal. We plan to interest a graduate student in taking on the work.

3. Complete third term on NSERC Population Grants Committee. Provide granting recommendations to Council. (Kerr)

This assignment, endorsed by DFO management, is now complete. During the final term over 400 grant applications were reviewed (app. 60 as principle reader), and site visits were made throughout eastern Canada.

4. Development of size-dependent multiple regression models for prediction of stock productivity from existing fisheries data, including scientific publication. (Boudreau)

A paper (Boudreau and Dickie) has been prepared and accepted for publication in the Can. J. Fish. Aquat. Sci. in early 1989 which uses a model based on size scaling of production processes to predict fisheries yield from three Scotian Shelf stocks. The paper shows that size scalings, which were observed in freshwater lakes and rivers, are also appropriate for marine species and that such information can provide useful estimates of habitat production.

5. Study the ecosystem stability characteristics on which biological assessments depend, in interaction with habitat and economic variables. Working papers will be presented within CAFSAC working groups. (Dickie)

The landings data series for fish stocks which are to be used in a study of the joint effects of biological and habitat impacts on fish stocks has been extended to several years earlier than previously available from computer landing records. Data analysis continues, using this extended series in an effort to evaluate the importance of autocorrelation within each of the time series on the cross correlation between biological and habitat parameters 283

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 710

Project Title: Benthic Habitat Studies

Project Leader: D.L. Peer

Other Researchers: T.W. Rowell, P. Woo, B.T. Hargrave

1. Project Description:

The benthic community is an important component of demersal fish habitats. Consequently, an understanding of its biological processes is essential to fisheries and habitat management. To that end, quantitative data on benthic invertebrate biomass, size distribution, and composition by major taxa are being collected from the coastal and shelf waters of eastern Canada.

2. Long-Term Objectives:

Measure and describe production processes of the benthic communities on the fishing grounds of Atlantic Canada. Benthic production will be related to such oceanographic processes as turbulent mixing, water depth, sedimentation and primary production, and to the production of demersal fish which feed on benthos.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Make quantitative benthic collections in the Sable Island Bank area. (Peer and Rowell)

A series of quantitative benthic samples was taken on a transect across Western and Sable Island Banks. Samples were taken for both macrofauna and meiofauna.

2. Collect molluscan fauna from the shelf off eastern Canada for organochlorine analysis, if funds provided by a proposed LRTAP project. (Peer and Rowell)

Samples were collected for the determination of atmospherically-derived organochlorines in Scotian Shelf benthos. This was done in support of Project E19 in Physical and Chemical Sciences Branch.

3. Production calculations as data become available from the Browns and Banquereau Banks areas. Development will continue on methods of estimating production from existing quantitative data. (Peer)

Quantitative meiofaunal data are available from 39 stations on Browns Bank. Twelve of these stations have macrofauna data and arrangements are being made to sort and analyze the remaining stations for macrofauna. Production calculations for these samples were delayed pending modification of the program to calculate benthic production, currently at St. Andrews, to work on a HED PC. This program contains the within taxa size distribution factor developed last year.

4. Prepare a publication on benthic production methods. (Peer)

The publication describing the within-taxa size distribution factor and comparing different types of allometric methods for benthic production remains in preparation.

4. Additional Accomplishments:

Support was provided to a proposal by Maritime Testing of Dartmouth to prepare a photographic atlas of the seabed of Eastern Canada. This project used an extensive collection of seabed photographs and organized them into benthic community and sediment types.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 727

Project Title: Inshore Molluscan Habitat Studies

Project Leader: T.W. Rowell

Other Researchers: P. Woo, D.L. Peer

1. Project Description:

This project involves basic biological and ecological research necessary for the management of the inshore molluscan habitat resources of the Scotia-Fundy Region. Research is directed at defining those biological and ecological parameters of key importance in the life cycle and productivity of inshore molluscs with the objective of providing scientific advice to fisheries habitat managers, fishermen, and aquaculturists.

2. Long-Term Objectives:

Develop scientific information on the biology and ecology of inshore molluscan shellfish resources and their habitat in order to optimize their production and define their importance to the productivity of inshore communities; and provide timely and scientifically sound advice to management.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Further evaluate the scale and importance of purported environmental changes in the Annapolis Basin, their relationship to man-made structures such as the causeway and hydroelectric development, and their impact on soft-shell clam production. Prepare synthesis of all scientific information pertaining to this issue and continue participation in the Annapolis Basin Working Group. (Rowell, Peer)

Planning and coordination of an extensive hydrographic survey by the F.G. Smith of all clam producing areas of the Annapolis Basin. Data are in the process of being compared to 1942 survey data for evidence of changes in sediment deposition. A part of the previously collected scientific information, including experimental data, was synthesized and published as a MS Report (expansion of below). Input provided to Annapolis Basin Clam Task Group to define requirements for Hindcast modelling, LISP project, and initial evaluation of previously collected aerial photography by MRMS.

2. Evaluate the impact of sediment deposition and suspended particulate matter on bivalve molluscs if ODCA research funding is received. (Rowell, Peer)

ODCA funding was not received but experiments related to this goal are being conducted (some already completed) under the Clam Enhancement Project as reported under goal 3) below (i.e. under the 1988/89 Atlantic Fisheries Development Program).

3. Evaluate the impact of current harvesting practice on soft-shell clams and their habitat as a basis for future management of the resource if funding is available from the Atlantic Fisheries Development Program. (Rowell)

Funding of a comprehensive Clam Enhancement Project under the 1988/89 Atlantic Fisheries Development Program has allowed us to mount a major cost-shared project between DFO and Dalhousie University (Jon Grant), in which several undergraduates and one Ph.D. student are involved, and resulted in the conduct of a number of experiments on the impact of digging practice and clam burial in various bottom substrates. Additionally, this project has been designed to collect the first-ever comprehensive database on catch/effort, areal extent of flats, area specific population and catch characteristics and fishery characteristics such as number of fishermen, harvesting practices, influences of tides and weather on catch, etc. These data are expected to provide sound baseline data for addressing both general fisheries management and habitat questions. The project is also expected to provide a basis for evaluating the potential and likely avenues for enhancement of the clam resource.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 701

Project Title: Microbial Ecology

Project Leader: J.E. Stewart

Other Researchers: L. Marks

1. Project Description:

Development of more rapid techniques for determination of bacterial types (genera), abundance and activities; application of those techniques in areas of interest to gauge impact of man-derived loadings on habitats i.e. fish farms, shellfish culture units, and areas flooded by sewage compared with control area; measurements of impact of surplus antibiotics and their effects on microbial systems; ultimately develop improved methods to measure nutrient flow via microorganisms and protozoa, and evaluate control over microbial activities by predators such as the Adelomyxidia and relevant protozoa.

2. Long-Term Objectives:

Assess and evaluate the roles and activities of microorganisms and their immediate predators (protozoa) in the marine and freshwater environments as agents of mineralization and converters and conveyors of nutrients and the influence of specific factors on this system. Since up to 50% of the primary production is channelled through the microbial system with possibly up to half of that entering the food chain through predation of bacteria, this is an important route in gauging overall aquatic production. Coupled with this is the fact that the microbial system is the route whereby organic waste such as sewage, surplus fish food and faeces, and dead material (plant and animal) is recycled and returned to the metabolic pool in useable forms. Obviously these systems can be affected by increased loadings and by specific contaminants including the large quantities of antibiotics from aquaculture. These have the capacity to alter materially microflora and induce bacterial resistance to antibiotics posing among other aspects the threat of producing dangerous strains of pathogens against which fish farmers will have little defense. These studies should aid in answering questions on productivity and habitat questions such as those concerned with the impact of aquaculture on coastal environments.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Complete the establishment of the laboratory.

Some equipment has been received and changes to the lab itself were effected. A basic laboratory will be in operation by the end of the calendar year.

2. Test, on a small scale, the possibility of using serological techniques to measure type and abundance of bacteria in natural samples.

Work is in hand to determine with readily available materials whether the serological test for gram negative bacteria is comparable to tests based upon the accepted measurement of endotoxin using Limulus amoebocyte lysates (LAL). This should be completed either by the end of December or in early January 1989.

4. Additional Accomplishments

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 702

Project Title: Molluscan Toxins I

Project Leader: J.E. Stewart

Other Researchers: L. Marks, D.V. Subba Rao

1. Project Description:

Preparation of a literature review of the work on the marine toxins known as Paralytic Shellfish Poisons (PSP), Domoic Acid, Diarrhetic Shellfish Poisons (DSP) and Brevetoxin and to aid in preparation of a "Kitchen" phytoplankton key of species found in the Atlantic Zone; collaborative studies leading to explanations for the production of large amounts of domoic acid (growth and biosynthesis); when domoic acid becomes available via DFO contracts, studies on microbial degradation will be carried out to determine which organisms degrade domoic acid and by which biochemical routes.

2. Long-Term Objectives:

Provide an understanding of previous work on marine toxins of relevance to the Atlantic Zone and aid in providing an understanding of the processes whereby domoic acid is produced and its ultimate disposition in nature.

Goals/Expected Outputs vs. Accomplishments in 1988:

1. Conduct Marine Toxins Literature Review (Stewart)

Work began and completion anticipated by the end of FY 1988/89.

2. Investigate the fate of Domoic Acid (Stewart, Rao)

No progress because domoic acid from DFO contracts is not yet available.

3. Work begun on production of domoic acid by Nitzschia pungens.4. Additional Accomplishments5. Goals/Expected Outputs for 1989:

1. Fate of domoic acid. Progress on isolating relevant microorganisms and in showing these microorganisms and capacity for degradation. (Stewart)

2. Production of domoic acid. Work is now in progress to determine how stress and nutrients influence production of domoic acid by Nitzschia pungens. It is expected that part of that work will be completed early in 1989 and will involve collaboration with Rao, Addison and Zitko.

3. Completion of Marine Toxins Review and Phytoplankton Key.

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 703

Project Title: Molluscan Toxins II

Project Leader: D.V. Subba Rao

Other Researchers: A. Orr

1. Project Description:

Both paralytic and diarrhetic shellfish poisoning (PSP, DSP) are caused by consumption of bivalve molluscs that have accumulated toxins produced by dinoflagellate algal blooms. During late 1987, an outbreak of shellfish poisoning resulting from eating cultivated blue mussels (*Mytilus edulis*) was associated with massive atypical, non-seasonal blooms of diatoms (*Nitzschia pungens*) not previously known to produce toxin. The toxin in question was domoic acid (a neurotoxic amino acid) and the intoxication resulted in sickness, human fatalities and substantial economic losses because of shellfish closures. That diatoms produce neurotoxins is a recent discovery, and several fundamental questions must still be elucidated: a) what are the physical-chemical characteristics that result in the development of non-seasonal toxic phytoplankton blooms?; b) besides *Nitzschia pungens*, what other taxa of phytoplankton produce domoic acid?; c) what is the rate of production of domoic acid by various diatom cultures?; d) what are the biochemical and physiological mechanisms that are responsible for the production of domoic acid by algal cultures?; e) how does domoic acid enter commercially important shellfish species and how is it accumulated?

This is a new project initiated in 1988.

2. Long-Term Objectives:

Study the origin, evolution and succession of phytoplankton blooms and the physical, nutritional and environmental factors that cause toxic algal blooms in areas of shellfish culture. It should then be possible to predict the possible development of a shellfish toxicity problem.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Analysed water samples collected during Dec 87 - March 88 from 31 sites of P.E.I. for nutrients and qualitative and quantitative abundance of phytoplankton.
2. Studies on the size-fractionated phytoplankton biomass and primary production were also carried out.
3. Domoic acid levels in natural bloom samples were analysed in collaboration with the Atlantic Regional Laboratory of NRC in Halifax.
4. Brought into culture several phytoplankton species with a view to screen them for the potential production of domoic acid.
5. That cultures of *Nitzschia pungens* do produce domoic acid was established.
6. Phytoplankton profiling survey programme was initiated. Four aquaculture sites (around Nova Scotia) were selected where nutrient levels, qualitative and quantitative abundance of algae and phytoplankton biomass are being monitored. Samples for domoic acid determinations were also collected.
7. Several pilot experiments aimed at the elucidation of development of toxic phytoplankton blooms are being carried out.

4. Additional Accomplishments:

PROJECT REVIEW, EVALUATION, AND PLANNING 1988/89

Division: Habitat Ecology Division

Project No.: 704

Project Title: Role of Picoplankton in the Marine Ecosystem

Project Leader: D.V. Subba Rao

Other Researchers: A. Orr

1. Project Description:

Picoplankton (0.4 μ m and 3.0 μ m) is ubiquitous and contributes up to 50% of the phytoplankton biomass and primary organic production in the marine environment. It has only recently been discovered, and several fundamental aspects must still be elucidated. These are: (a) develop a reliable methodology to fractionate and quantify picoplankton, (b) determine the physico-chemical factors that regulate their spatial and temporal variations, and (c) determine the role that picoplankton play in the pelagic food web of the marine ecosystems. This project has relevance to the estimates of global primary production and to some fisheries.

2. Long-Term Objectives:

Study the response of picoplankton, employing both natural assemblages and laboratory cultures, to environmental variables such as light, temperature, nutrients, and certain trace elements; obtain a wider database on the spatial and temporal variations of picoplankton with a view to revising estimates of the global ocean primary production; and determine if picoplankton constitute a source of food for heterotrophic nanoplankton and larval microzooplankton such as scallop veligers.

3. Goals/Expected Outputs vs. Accomplishments in 1988:

1. Complete analyses of data from the mid-Atlantic ridge cruise and the Georges Bank cruise. Continue similar studies during cruises in 1988.

Most of the data on the changes in size fractionated biomass and primary production in experimental samples (with a gradient in phytoplankton) due to microzooplankton grazing are processed. These studies were carried out during a mid-Atlantic ridge cruise to determine the importance of microzooplankton grazing in oligotrophic oceanic waters overlying sea-mounts. Data were obtained on the effect of scallop larval grazing on phytoplankton abundance and production over Georges Bank where the scallop fishery is important. During October 1988 additional experiments were carried out on scallop larval grazing on Georges Bank. The data are being processed and will be brought to publication in future.

2. Continue studies on the physiological ecology of phytoplankton and picoplankton.

During the mid-Atlantic Ridge cruise and Georges Bank cruise, data were collected on the abundance, distribution and production characteristics of picoplankton. Experiments aimed at determining the role of picoplankton in the trophodynamics were also carried out.

3. Carry out research as required by the new organizational structure.

See Project 703 for progress made on toxic phytoplankton blooms.

4. Additional Accomplishments:

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: W.D. Watt

Telephone: (902) 426-3606

Title: Biologist

Address: P.O. Box 550, Halifax, N.S. B3J 2S7

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Research is to assess the effects of 'Acid Rain' and other airborne pollutants on east coast freshwater fish. The 'Biomonitoring' program is long term and is to detect trends in aquatic communities caused by substances transported long distances to affected sites. Effects of pollution control can also be monitored by this program.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Dr. Don Gordon, Bedford Institute of Oceanography

Dr. Gilles LaCroix, St. Andrews Biological Station, St. Andrews, N.B.

INDICATOR RESEARCH PROJECT DESCRIPTION

Project #170

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Biomonitoring long range transport of air pollutants.

Project objective(s)

To monitor long-term changes in aquatic communities across Canada. Standard survey methods are followed at different sites to make data comparable. Fish and invertebrate communities are surveyed. Surveys in Nova Scotia are conducted by Scotia-Fundy Region staff. Surveys in other regions are conducted by local staff of D.F.O.

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?



Fisheries and Oceans
Pêches et Océans

Gulf Region
Science Branch
P.O. Box 5030
Moncton, New Brunswick
EIC 9B6

Your file Votre référence

Our file Notre référence

November 14, 1989

1152-E2

Mr. Gregg Sheehy, B.E.S., M.Sc.F.
Environmental Consultant
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

Subject: Environmental Indicator Research Network

Thank you for your letter requesting information for the development of an environmental indicator research network.

In response, I have enclosed a description of our organization and its objectives as well as a summary of the major elements and priorities of our research programmes and the managers responsible for them.

A list of individual projects and project leaders is also enclosed with a listing of our professional staff and their individual areas of expertise. The latter has been extracted from the *"Directory of Marine and Freshwater Scientists in Canada"* (Canadian Special Publication of Fisheries and Aquatic Sciences # 104). I would recommend the use of this directory in your pursuit of other contacts for the research network.

A *"Roster of Experts"* consisting of regional staff who could provide advice on habitat issues and various man-made impacts to fish and fish habitat is also included.

I trust that this will be acceptable and if you have any further questions, please contact Bill Ritchie [tel. (506) 857-6230] of my staff.

Yours truly,

J.S. Loch
Regional Director

Attach.

cc: D.R. Alexander

Canada

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Bill Ritchie

Telephone: 506-857-6230

Address: Fisheries and Oceans Canada, Gulf Region, Science Branch,
P.O. Box 5030, Moncton, New Brunswick E1C 9B6

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).

See following page describing the Biological Sciences Division, DFO
Science Branch, Gulf Region

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

ACCOUNTABLE MANAGER SUMMARY

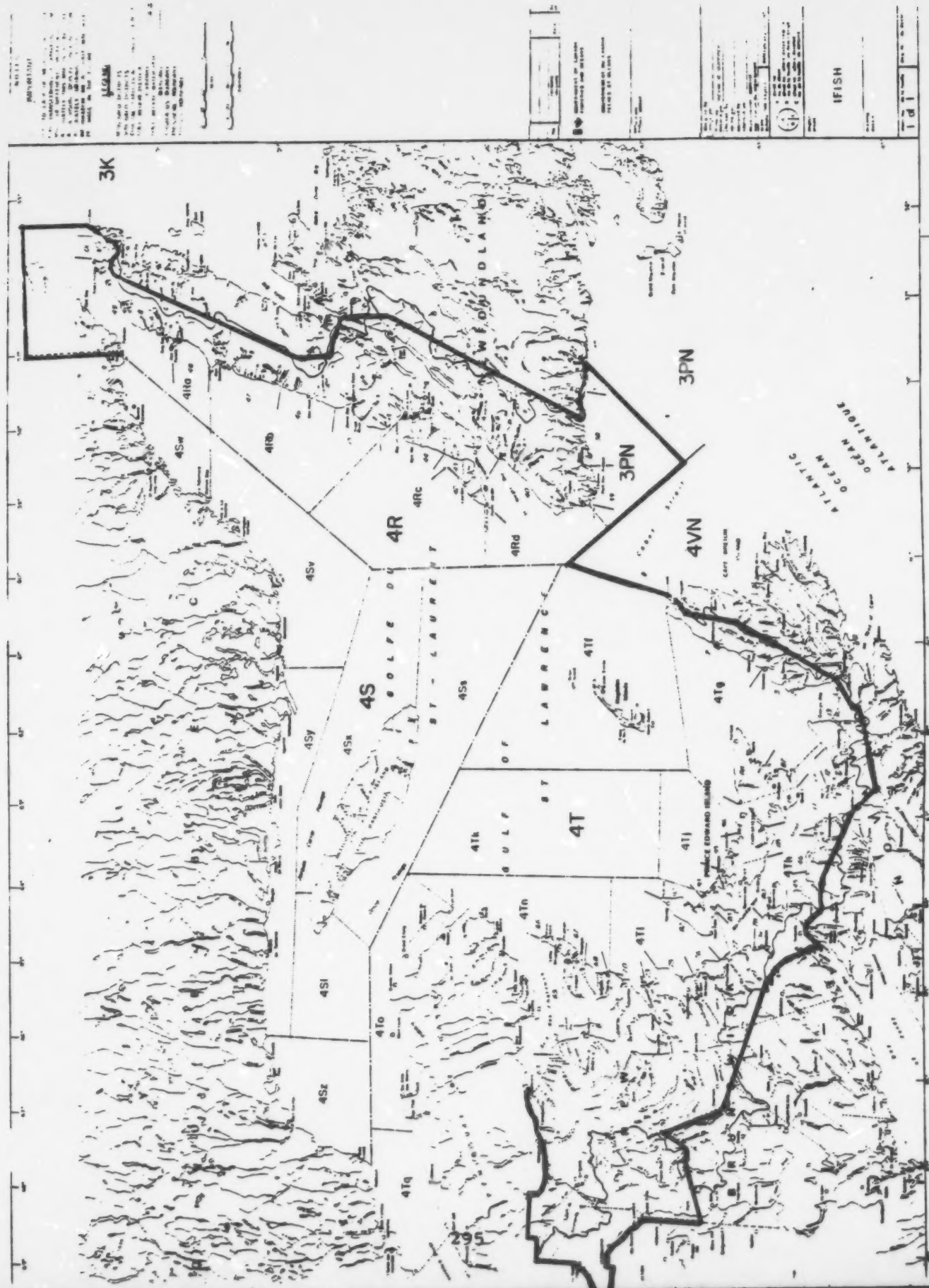
<u>Branch:</u>	Gulf Science	<u>Planning Element:</u>	1. Fisheries & Oceans Science
<u>Accountable Manager:</u>	J.S. Loch	<u>Work Activity:</u>	1.1 Biological Sciences
<u>Division:</u>	Biological Sciences		
<u>Collators:</u>	4950 - 4983		

ORGANIZATIONAL UNIT DESCRIPTION: Gulf Science Branch is one of six regional Canadian establishments whose mandate is to conduct research on aquatic ecosystems, and particularly to acquire the scientific data, information and knowledge needed for conservation, preservation, restoration, augmentation and culture of the aquatic renewable resources, for the wise use of the habitats upon which they depend, and for planning, evaluation and control of the commercial, recreational and native fisheries; to provide scientific advice and professional services in those areas as well as in other specialized fields such as aquaculture, fish health, toxicology, limnology, systematics and the physiology of aquatic organisms; and to develop and refine methodology relevant to the above. More specifically, in relation to Gulf Science and with respect to objectives 1 and 2 below, the Gulf Fisheries Science Branch is divided into 2 Divisions that reflect the biological differences between invertebrates and finfish. There is a third Division that is responsible for objective 3 and the salmonid enhancement aspects of objective #2. All 3 Divisions are responsible for client consultation and provision of advice. Consequently, there are 3 Divisions - Invertebrates (which includes 6 responsibility centres - Vessels, Crustacean Assessment, Molluscan Assessment and Aquaculture, Fish Health and Aquaculture Coordination, Parasitology and Division Chief), Marine and Anadromous Fish (which includes 3 responsibility centres - Pelagics, Groundfish, Division Chief) and the Fish Habitat & Enhancement Division (3 responsibility centres - Habitat Improvement and Assessment, Salmonid Enhancement, Division Chief). It should be noted that Gulf Science has no mandate and, therefore, no capability for Physical and Chemical Sciences or Hydrography. These are provided by Scotia/Fundy and Quebec regions.

ORGANIZATIONAL OBJECTIVE:

1. To develop and improve the scientific knowledge base on the population status, biology, dynamics and ecology exploited and related species in the Gulf of St. Lawrence waters (marine and anadromous species);
2. To develop and improve the scientific knowledge base on the intensive production of salmon and molluscs and for restoring and augmenting the production of wild stock, as well as for developing a burgeoning molluscan/aquaculture industry, as well as supporting public salmon enhancement; and for curbing the introduction and spread of communicable fish diseases;
3. To develop the scientific knowledge base on potential and actual damage to fish and their habitat due to human disturbance (other than direct harvesting) or methods of restoring damaged habitat and developing new habitat on anticipating new or escalating habitat threats;
4. To transfer the knowledge base procured through the 3 objectives above to resource managers, industry and the fishermen through the formal and informal provision of relevant advice.

DFO GULF REGION



INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ☒ 1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Dioxin Program

Project objective(s): Carrying out the Treasury Board approved dioxin program related to dioxin in bleached kraft pulp and paper mill effluents.

Geographic scope (circle one): global
national
☒ regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Shellfish Phycotoxin Program

Project objective(s): To develop a long-term program investigating shellfish phycotoxins.

Geographic scope (circle one): global
national
regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: fisheries advice

Project objective(s): Provision of credible, accurate and timely scientific advice and forecasts on the status of fish populations to meet management requirements for groundfish, herring, Atlantic salmon, snow crab and gaspereau.

Geographic scope (circle one): global
national
① regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: improving survey methods

Project objective(s): Undertake initiatives to improve the reliability of scientific advice by developing programs to improve survey methods for estimating stock abundance, and models and analytical techniques to forecast yields and implications of alternate harvest levels..

Geographic scope (circle one): global
national
regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: habitat evaluation techniques

Project objective(s): Development of techniques to quantify and evaluate the productivity of fish habitat.

Geographic scope (circle one): global
☒ national
regional
local

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ④ quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: research on fish recruitment and distribution

Project objective(s): Conduct research on fish recruitment and distribution, and develop a national strategy for research on factors influencing recruitment in marine fish populations.

Geographic scope (circle one): global
national
regional
local

15 Department of Fisheries and Oceans
P.O. Box 5030
Moncton, New Brunswick
E1C 9B6

Telephone: (506) 857-6257

Telex: 014-2807

FAX: (506) 857-6227 857-732

Mr. J. S. Loch, Regional Director

Alexander, R. D., M.Sc.

anadromous fishes, fisheries assessment,
freshwater fishes, population studies,
productivity, river and stream ecology/
resource assessment, resource
management, scientific research/freshwater
environment

Angus, R. B., B.Sc.

mollusks, crustaceans, population studies,
aquaculture/development, scientific
research/marine environment

Bastien-Daigle, S., B.Sc.

river and stream ecology/impact
assessment/estuarine, freshwater and
marine environments

Cairns, D., Ph.D.

marine fishes/scientific research, resource
assessment/marine environment

Cameron, P. M., B.Sc.

anadromous fishes, aquaculture, freshwater
fishes/development, technology transfer/
freshwater and marine environments

Campbell, J. S., Ph.D.

anadromous fishes, freshwater fishes,
marine fishes, fisheries assessment/
research management/freshwater and
marine environments

Campbell, M. I., M.Sc.

aquaculture, diseases and parasites/
consulting, policy development, technology
transfer/estuarine, freshwater and marine
environments

Chadwick, M. E. P., Ph.D.

anadromous fishes, population studies/
research management, resource
assessment, scientific research/freshwater
and marine environments

Chiasson, Y., B.Sc.

invertebrates, crustaceans, fisheries
assessment/resource assessment, scientific
research/marine environment

Chouinard, G. A., B.Sc.

marine fishes, fisheries assessment,
mollusks/resource assessment, scientific
research/marine environment

Clay, D., Ph.D.

population studies, marine fishes,
freshwater fishes, fisheries assessment,
aquaculture/resource assessment, scientific
research/freshwater and marine
environments

Clayton, R. R., M.Sc.

fisheries assessment, anadromous fishes,
population studies, genetics/resource
assessment, scientific research/freshwater
environment

Comeau, M., M.Sc.

invertebrates, crustaceans, population
studies/scientific research, research
management/marine environment

Conan, G. Y., Ph.D.

fisheries assessment, population studies,
invertebrates, computer science,
biostatistics, modeling/program
management, scientific research, teaching/
marine environment

Cunjak, R. A., Ph.D.

anadromous fishes, freshwater fishes,
behavior, physiology, river and stream
ecology/scientific research, research
management/estuarine and freshwater
environments

Davidson, K., M.Sc.

invertebrates, anadromous fishes,
aquaculture/resource assessment, scientific
research/estuarine, freshwater and marine
environments

Dupuis, H., Ph.D.

population studies, anadromous fishes,
biostatistics/resource assessment, scientific
research/freshwater and marine
environments

Eisner, R. A., B.Sc.

aquaculture, anadromous fishes, freshwater
fishes, fisheries engineering/research
management, scientific research, resource
management/estuarine and freshwater
environments

Gray, F. W., M.Sc.

anadromous fishes, freshwater fishes,
aquaculture, river and stream ecology,
taxonomy and systematics, physiology/
development, scientific research, resource
assessment/freshwater environment

Hambrook, M., B.Sc.

anadromous fishes, freshwater fishes,
aquaculture/development, technology
transfer/freshwater environment

- Hare, G. M., Ph.D.
diseases and parasites, population studies,
fisheries assessment/research
management/marine environment
- Landry, T. J., M.Sc.
diseases and parasites, population studies,
fisheries assessment/resource assessment,
research management/marine environment
- Lanteigne, M., M.Sc.
fisheries assessment, invertebrates,
population studies, mollusks/scientific
research, resource assessment/estuarine
and marine environments
- Loch, J. S., M.Sc.
fisheries assessment, science policy,
marine fishes, anadromous fishes,
freshwater fishes/research management/
estuarine, freshwater and marine
environments
- Lutzac, T. G., M.Sc.
biology, anadromous fishes, behavior,
aquaculture, fisheries assessment,
population studies/scientific research,
development, resource assessment/
freshwater environment
- Mallet, P., B.Sc.
invertebrates, crustaceans, physiology/
resource assessment, scientific research/
marine environment
- Maynard, D. R., B.Sc.
invertebrates/resource assessment/
estuarine and marine environments
- McGladdery, S. E., Ph.D.
diseases and parasites, population studies/
scientific research/freshwater and marine
environments
- Moriyasu, M., Ph.D.
invertebrates, crustaceans, physiology,
population studies, marine ecology/
scientific research, resource assessment/
marine environment
- Morry, C., M.Sc.
estuarine ecology, environmental planning,
pollution, marine ecology, lake ecology,
river and stream ecology/impact
assessment, resource management,
computer applications/estuarine, freshwater
and marine environments
- Nielsen, G., M.Math.
computer science/computer applications,
resource assessment/marine environment
- Peppar, J. L., M.Sc.
anadromous fishes, fisheries assessment,
population studies, river and stream
ecology/resource assessment, resource
management, development/estuarine and
freshwater environments
- Randall, R. G., Ph.D.
anadromous fishes, population studies,
productivity, river and stream ecology,
fisheries assessment/research
management, scientific research/freshwater
and marine environments
- Sephton, T. W., Ph.D.
biology, fisheries assessment, invertebrates,
population studies, mollusks, productivity/
program management, scientific research,
teaching/estuarine and marine
environments
- Sinclair, A., M.E.S.
fisheries assessment, population studies/
resource assessment, scientific research,
consulting/marine environment
- Smith, J. C., Ph.D.
aquaculture, mollusks, physiology,
phytoplankton, biochemistry/scientific
research/marine environment
- Tallman, R., Ph.D.
population studies, genetics, fisheries
assessment/resource assessment, scientific
research/marine environment
- Wade, E. L., B.Sc.
instrumentation, engineering techniques,
computer science/scientific support, design,
computer applications/estuarine and marine
environments
- Worms, J., Ph.D.
population studies, genetics, mollusks,
biology, aquaculture/scientific research/
estuarine and marine environments
- Wright, J. A., Ph.D.
computer science/computer applications,
resource assessment/freshwater and
marine environments
- 16 Department of Fisheries and Oceans
Biological Station
St. Andrews, New Brunswick
E0G 2X0
Telephone: (506) 529-8854
Telex: 014-47264
FAX: (506) 529-4274
Dr. R. H. Cook, Director

ROSTER OF EXPERTS

Agricultural Runoff

D. Caissie 857-6287

Aquaculture Development/Operation

M.I. Campbell (Fish Health) 857-6247

J. Worms (Shellfish) 858-2056

K. Davidson (Salmonids) 858-2074

Bridges and Tunnels

R. Alexander 857-6251

J. Conlon 857-6229

Causeway/Barrage Development

W. Ritchie 857-6230

D. Caissie 857-6287

Construction - General

J. Conlon 857-6229

Contaminants/Toxicants (General)

R. Alexander 857-6251

E. Arsenault 857-6564

Dredging

D. Caissie 857-6287

Fish Passage

R. Gray 857-6236

Fisheries Compensation

R. Alexander 857-6251

Fishing Activity

S. Campbell 857-6206

G. Conan 857-6208 (6145)

Forestry

W. Ritchie 857-6230

Habitat, Evaluation

R. Cunjak 858-2002

W. Ritchie 857-6230

D. Caissie 857-6287

Habitat, Freshwater

R. Cunjak 858-2002

R. Gray 857-6236

R. Alexander 857-6251

T. Lutzac 857-6245

W. Ritchie 857-6230

Habitat Improvement/Restoration

R. Gray 857-6236

T. Lutzac 857-6245

S. Bastien-Daigle 858-7748

Habitat, Inventory (GIS)

J. Legault	857-6221
A. Vromans	858-2049

Habitat, Shellfish

J. Worms (Molluscs)	858-2056
M. Comeau (Crabs)	857-6136
M. Moriyasu (Crabs)	857-6135
D. Maynard (Lobster)	857-6212

Incineration at Sea

R. Whalen	857-6568
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Long Range Transport of Atmospheric Pollutants

R. Alexander	857-6251
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Marine Parks/Reserves

R. Alexander	857-6251
W. Ritchie	857-6230

Plastic Debris

R. Alexander	857-6251
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Road Construction

J. Conlon	857-6229
W. Ritchie	857-6230

Sedimentation Impacts

R. Alexander	857-6251
D. Caissie	857-6287
R. Cunjak	858-2002
W. Ritchie	857-6230

Shellfish Toxins

J. Worms (Invertebrates)	857-2056, 3820
R. Cormier (Inspection/ Monitoring)	858-2048
J. MacLean (Inspection/ Monitoring)	857-6571

Thermal Power Stations, General

W. Ritchie	857-6230
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Thermal Effluents

D. Caissie	857-6287
W. Ritchie	857-6230



Pêches
et Océans

Fisheries
and Oceans

October 18, 1989

Mr. Gregg Sheehy
Environmental Consultant
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

SUBJECT: SOE indicators research

Dear Mr Sheehy:

As requested, please find attached information on research work related to environmental indicators and conducted by our people.

I hope this is of value to you.

Yours truly,

p: Jean Boulva
Regional Director, Science

RA/rc

encl.

Canada

Institut Maurice-Lamontagne
Pêches et Océans
Caser postal 1000
Mont-Joli (Québec) Canada
G5H 3Z4
Tél: (418) 775-6500
Télécopieur: (418) 775-6542

Maurice Lamontagne Institute
Fisheries and Oceans
P.O. Box 1000
Mont-Joli, Quebec, Canada
G5H 3Z4
Telex: 051-8-8303

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: J.N. Gearing

Telephone: (418) 775-6590

Title: Chercheur scientifique

Address: Institut Maurice-Lamontagne
850 Route de la Mer, Mont-Joli (Québec) G5H 3Z4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

- Mesurer les contaminants organiques dans le Saint-Laurent;
- Déterminer leurs sources, les principaux processus affectant leur distribution et leur sort dans cet écosystème marin;
- Examiner le comportement de la matière organique en général - composés naturels et anthropogéniques.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

2001-10-14

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of project

Géochimie organique du Saint-Laurent - Variations spatio-temporelles enregistrées dans les sédiments

Project objective(s)

- Mesurer les divers lipides dans les carottes du sédiment (pétrole HC, PAH, FA, PCB, etc.)
- Relier les variations spatiales aux sources;
- Déterminer les changements des apports dans le temps.

Geographic scope (circle one)

global

national

☒ regional with national implications

local

If regional or local, what is the geographic area covered?

Estuaire du Saint-Laurent/Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of project

Géochimie organique du Saint-Laurent - Variabilité de la matière organique en suspension

Project objective(s)

- Mesurer les hydrocarbures aliphatiques (pétrole) et aromatiques (PAH) dans les particules en suspension;
- Déterminer l'étendue de la pollution;
- Déterminer les changements en fonction de la taille;
- Déterminer les changements saisonniers;
- Déterminer les changements causés par la décomposition.

Geographic scope (circle one)

global

national

☒ regional

Avec implications globales

local

If regional or local, what is the geographic area covered?

Estuaire du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
- ⑤ size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of project

Procédés biologique et chimique affectant les abondances naturelles du C-13 et N-15

Project objective(s)

- Mesurer le C-13 et le N-15 dans différentes classes de taille de plancton afin de déterminer si ceci peut être utilisé pour détecter la matière organique du nanoplancton;
- Calculer l'étendue de l'influence terrigène sur le Saint-Laurent.

Geographic scope (circle one)

① global

national

regional

local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Charles Gobeil

Telephone: (418) 775-6591

Title: Océanographe géo-chimiste

Address: Institut Maurice-Lamontagne
850 Route de la Mer, Mont-Joli (Québec) G5H 3Z4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Le mandat est la préservation de la qualité du milieu marin. Les travaux effectués visent à déterminer le niveau des contaminants dans ce milieu. Les résultats obtenus permettent de connaître les mécanismes de transport des contaminants, d'identifier des sources de pollution et, si possible de mieux gérer le milieu sous notre responsabilité.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of project

Accumulation et cycle du plomb dans les sédiments en milieu marin côtier

Project objective(s)

Faire le point sur la pollution par le plomb dans le golfe du Saint-Laurent, le bras de mer Jervis (côte ouest) et la mer de Beaufort.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of project

Rôle de l'interface eau-sédiment dans le cycle du phosphore en milieu marin.

Project objective(s)

Connaître le rôle des interactions eau-sédiment sur le cycle du phosphore dans l'estuaire et le golfe du Saint-Laurent.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Estuaire et golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of project Distribution et diagénèse du mercure dans les sédiments du chenal Laurentien.

Project objective(s)

Faire le point sur la pollution par le mercure dans le système de l'estuaire et du golfe du Saint-Laurent.

Geographic scope (circle one)

global

national

☒ regional

local

If regional or local, what is the geographic area covered?

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
- ⑨ exposure of fish and wildlife to toxic chemicals.

Name of project L'arsenic dans le fjord du Saguenay

Project objective(s)

Etude de la pollution par l'arsenic dans le fjord du Saguenay.

Geographic scope (circle one)

global

national

⑧ regional

local

If regional or local, what is the geographic area covered?

Fjord du Saguenay, Québec.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: P. V. Hodson

Telephone: (418) 775-6647

Title: Toxicologiste du poisson

Address: Institut Maurice-Lamontagne
850 Route de la Mer, Mont-Joli (Québec) G5H 3Z4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Diriger et diagnostiquer la toxicité chimique dans les populations naturelles de poisson dans des eaux polluées. Ceci contribue à: la protection du poisson, la protection de l'habitat et le monitoring environnemental de qualité.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
- ⑨ exposure of fish and wildlife to toxic chemicals.

Name of project Indicateurs de toxicité chimique dans le poisson

Project objective(s)

- Développer et appliquer les indicateurs de toxicité basés sur les réponses biochimiques et physiologiques du poisson;
- Faire correspondre les réponses de ces indicateurs à la contamination chimique et aux impacts sur la productivité et la structure des populations.

Geographic scope (circle one)

global

national

⑨ regional

local

If regional or local, what is the geographic area covered?

Québec - Golfe du Saint-Laurent - Fleuve Saint-Laurent et ses tributaires.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Michael Kingsley Telephone: (418) 775-6787
Title: Chef, Division des Mammifères marins et de la parasitologie
Address: Ministère des Pêches et des Océans
Institut Maurice-Lamontagne
C.P. 1000
Mont-Joli G5H 3Z4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Cette division conduit divers projets sur la biologie, le comportement, la distribution et la contamination de certaines espèces de mammifères marins afin de mieux évaluer les stocks ou fournir les données pour la protection de ces espèces.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Great whales .

PROJECT OBJECTIVE(S):

- Increased knowledge of cetacean distribution, abundance, exploitation, ecological interactions, natural history and morphological adaptations in the North Atlantic, Gulf of St. Lawrence, Arctic and other areas of interest.

GEOGRAPHIC SCOPE ;

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent
Nord de l'Atlantique
Région arctique

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Odontocete research.

PROJECT OBJECTIVE(S):

To conduct research into the biology and ecology of odontocetes, and to disseminate the results. To advise resource managers on the exploitation of odontocete stocks, on the interactions between odontocetes and fisheries, and on the effect on odontocete populations of marine activities.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Arctique

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Gulf pinniped ecology research.

PROJECT OBJECTIVE(S):

To conduct research into the distribution, abundance, population dynamics, behaviour, and ecology of pinnipeds in the estuary and Gulf of the St. Lawrence, and their interactions, both predatory and parasitological, with commercial fisheries. To monitor the levels of pollutants in seal tissues, and study their biotoxicology. To communicate research results to the scientific community, to fisheries resource managers, and to Departmental management as necessary for structuring the departments response to management issues and public concerns.

Geographic scope: Régional , Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Arctic Pinnipeds.

PROJECT OBJECTIVE(S): To conduct research into the population dynamics, numbers, movements and distribution, feeding habits, and ecological interactions of Arctic pinnipeds including walrus, ringed seals, bearded seals, and harp seals.

GEOGRAPHIC SCOPE ;

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Arctique

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Contamination chez le marsouin commun.

PROJECT OBJECTIVE(S): Initiation d'un projet concernant les niveaux de contamination des animaux échoués comparativement aux animaux pris accidentellement dans les filets.

GEOGRAPHIC SCOPE ;

global
national
✓regional
local

If regional or local, what is the geographic area covered?: Côte Nord du Golfe Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Revue de la documentation sur les effets des BPC et des HAP sur le système immunitaire.

PROJECT OBJECTIVE(S): Déterminer des avenues de recherche concernant les effets de BPC et de HAP sur le système immunitaire.

GEOGRAPHIC SCOPE ;

global
national
regional
local

If regional or local, what is the geographic area covered?: sans objet.

SURVEY QUESTIONS

Your Name: Alan Sinclair Telephone: (418) 775-6643
Title: Chef, Division de la Recherche sur les pêches
Address: Ministère des Pêches et des Océans
Institut Maurice-Lamontagne
C.P. 1000
Mont-Joli G5H 3Z4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Un des principaux mandats de la division de la Recherche sur les pêches est d'évaluer les ressources exploitées ou potentiellement exploitables par l'industrie de la pêche : hareng 4RS, cabas 4Rst, morue 4RS, maquereau de l'Atlantique et turbot 4Rst, crevette 4Rst, crabe de la Côte-Nord. De plus, cette division s'occupe d'autres espèces exploitées par les pêcheurs québécois : le langouste, le calmar, le bucrin, les pétoncles, les myxos et les plantes marines.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Organisation spatiale des agrégations de crevette: détermination des mécanismes de contrôle et description des caractéristiques démographiques associées à une répartition différentielle.

PROJECT OBJECTIVE(S): Trouver les mécanismes responsables de la dynamique de la répartition spatiale de la crevette sur les plans horizontal et vertical: mettre en évidence les facteurs régissant la formation, le maintien et la dispersion des agrégations de crevette dont dépendent les rendements des crevettiers commerciaux. Fournir l'information de base requise pour améliorer et faciliter l'évaluation des stocks de crevette. Caractériser la dynamique de production des ressources halieutiques du nord du Golfe dont les crevettes.

GEOGRAPHIC SCOPE ;

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation des populations de Capelan exploitées.

PROJECT OBJECTIVE(S):

Elaborer une méthode d'évaluation des populations de Capelan en vue de présenter des avis scientifiques au comité CSCPCA.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Québec ou Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Echantillonnage des espèces halieuthiques commercialement exploitées.

PROJECT OBJECTIVE(S):

Planifier, organiser et exécuter un programme d'échantillonnage visant les espèces de poissons et d'invertébrés marins commercialement exploités dans la région du Québec dans le but de recueillir les données nécessaires à l'évaluation des populations visées.

GEOGRAPHIC SCOPE ;

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Québec.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation de la ressource et présentation des conseils scientifiques sur les pétoncles.

PROJECT OBJECTIVE(S):

Quantifier l'état de la ressource afin de fournir des conseils adéquats pour assurer une gestion efficace et optimale de la pêche des pétoncles au Québec. Obtenir l'information sur le niveau d'exploitation de la ressource. Assurer la présence d'une personne-ressource lors des réunions de comités consultatifs.

GEOGRAPHIC SCOPE ;

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Régions : Des-Sa-La-Madeleine
Côte-Nord.
Baie-des-Chaleurs.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation de l'état des stocks de Crabe des Neiges de l'Estuaire et du nord du golfe du Saint-laurent en 1989.

PROJECT OBJECTIVE(S):

Analyser les informations provenant des statistiques de pêche et les informations biologiques de toutes provenances qui ont un rapport à ces stocks afin d'en déterminer l'état actuel.

Planifier et exécuter des projets de recherche orientés plus spécifiquement vers la connaissance de la biologie, de l'écologie et de l'abondance de cette espèce dans l'estuaire et le nord du golfe du Saint-Laurent.

Présenter les résultats de ces analyses et projets sous forme de rapports et publications scientifiques et/ou sous une forme vulgarisée à nos différents clients du domaine de la pêche.

Finaliser la réalisation de documents sur le marquage et l'échantillonnage des juvéniles du Crabe des Neiges de ces régions.

GEOGRAPHIC SCOPE :

- global
- national
- ✓ regional
- local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation des stocks de crevette du Golfe et présentation des conseils scientifiques.

PROJECT OBJECTIVE(S):

Evaluer l'abondance de la ressource, évaluer les niveaux de capture correspondant au taux d'exploitation annuel visé et suivre l'évolution de l'exploitation commerciale dans les cinq unités de gestion du Golfe; produire les conseils scientifiques nécessaires pour la gestion des stocks; assurer la présence d'une personne-ressource lors des réunions de comités consultatifs.

GEOGRAPHIC SCOPE ;

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Crustacés/crevette: fluctuations des rendements de la pêche à la crevette nordique; mécanismes de contrôle de la répartition spatiale de la ressource sur les plans horizontal et vertical.

PROJECT OBJECTIVE(S):

- Trouver les mécanismes responsables de la dynamique de la répartition spatiale de la crevette sur les plans horizontal et vertical: mettre en évidence les facteurs régissant la formation, le maintien et la dispersion des agrégations de crevette dont dépendent les rendements des crevettiers;
- Vérifier la faisabilité, et mettre au point une méthode d'estimation de la biomasse par hydroacoustique à double faisceaux et deux fréquences;
- Fournir l'information de base requise pour améliorer et faciliter l'estimation des stocks de crevettes;
- Caractériser la dynamique de production des ressources halieutiques du nord du Golfe du Saint-Laurent.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Impact of changes in environmental conditions on fish distributions.

PROJECT OBJECTIVE(S):

To provide information concerning the distribution, ecology and behaviour of marine fishes in relation to environmental conditions, migration, recruitment and life history patterns.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Hydrodynamisme, distribution et croissance des larves de hareng dans l'estuaire du Saint-Laurent.

PROJECT OBJECTIVE(S):

- Définir les caractéristiques hydrodynamiques de l'estuaire moyen.
- Déterminer la distribution verticale et horizontale des larves et de leur ressource alimentaire en relation avec la structure physique du milieu.
- Evaluer la croissance et la condition des larves.
- Déterminer la durée de la phase larvaire.
- De façon générale, évaluer l'importance de l'environnement physique dans le contrôle de la variabilité du recrutement chez le hareng.

GEOGRAPHIC SCOPE ;

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Estuaire du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Evaluation de la ressource de hareng dans les divisions 4RS.

PROJECT OBJECTIVE(S): Quantifier l'état de la ressource de hareng dans la division 4 R de l'OPANO afin de fournir les conseils scientifiques nécessaires pour la gestion. Répondre aux questions précises provenant des gestionnaires sur la biologie des stocks de hareng dans la division 4S. Assurer la présence d'une personne-ressource lors des réunions de comités scientifiques et consultatifs afin de présenter les résultats et les conseils scientifiques. Gérer les ressources humaines et financières attribuées au projet. Participer aux activités de la section, de la division et de la Direction en vue d'aider au bon fonctionnement de l'organisation.

GEOGRAPHIC SCOPE ;
global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Etude de la distribution de sébaste des divisions 4RST telle que déterminée à partir des données de la pêche commerciale.

PROJECT OBJECTIVE(S): Etablir la distribution saisonnière de la portion exploitée du stock de sébaste et l'association possible entre le patron de distribution et la température, à partir des données de la flotte commerciale.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation du stock de sébaste des divisions 4RST.

PROJECT OBJECTIVE(S):

- Quantifier l'état de la ressource afin de produire les conseils scientifiques nécessaires à la gestion du stock de sébaste des divisions 4RST;
- Assurer la présence d'une personne-ressource lors des réunions de comités scientifiques et/ou consultatifs;
- Suivre l'évolution de l'exploitation de la ressource.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation du stock de maquereau.

PROJECT OBJECTIVE(S): Estimer l'abondance de la population de maquereau du golfe du Saint-Laurent à partir des données de pêche commerciale et de données de production d'oeufs afin de produire les conseils scientifiques nécessaires à la gestion du stock.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Nord-ouest de l'Atlantique

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Patrons d'exploitation de la morue par la flotte Française et la zone marginale des glaces.

PROJECT OBJECTIVE(S): Nous voulons prouver que les conclusions d'une étude précédente qui indiquait que fortes concentrations de morue se situaient dans la zone marginale des glaces était utilisée par la flotte commerciale et que ce phénomène aurait une influence sur le patron (et le succès) de la pêche hivernale.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation de la morue et présentation des conseils de gestion.

PROJECT OBJECTIVE(S): Evaluer la taille du stock afin de produire les conseils scientifiques nécessaires pour la gestion des stocks. Etre présent comme personne ressource lors des réunions de comités scientifiques et/ou consultatifs. Obtenir de l'information sur l'exploitation de la ressource pour interpréter les statistiques de captures.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Études biologiques du pétoncle d'Islande (Chlamys islandicus), dans le détroit d'Hudson

PROJECT OBJECTIVE(S): Obtenir de l'information biologique permettant d'améliorer la capacité de procurer des avis scientifiques à la gestion du pétoncle d'Islande dans le détroit d'Hudson.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Détroit d'Hudson

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Etudes biologiques de la crevette nordique Pandalus montagui dans le détroit d'Hudson.

PROJECT OBJECTIVE(S): Obtenir de l'information biologique permettant d'améliorer la capacité de procurer des avis scientifiques à la gestion de la crevette nordique dans le détroit d'Hudson.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Détroit d'Hudson

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Pêche exploratoire sur la côte de la Baie James.

PROJECT OBJECTIVE(S): Obtenir de l'information biologique permettant d'améliorer la capacité de donner des avis scientifiques à la gestion des poissons côtiers au Nouveau-Québec.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Baie James

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation du stock de flétan du Groenland du Golfe du Saint-Laurent.

PROJECT OBJECTIVE(S): Fournir les avis sur l'état de la ressource du flétan du Groenland (Reinhardtius hippoglossoides (Walbaum) dans le Golfe du Saint-Laurent (Divisions de l'OPANO 4 RST).

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT; Etude écologique sur la morue (Gadus morhua Linne) du nord du Golfe du Saint-Laurent.

PROJECT OBJECTIVE(S): Déterminer des paramètres écologiques de base sur la morue du Nord du Golfe du Saint-Laurent, en particulier en ce qui a trait au rôle écologique de ce prédateur situé au haut de la chaîne trophique du Golfe, et de ses migrations et mouvements dans le Golfe.

GEOGRAPHIC SCOPE ;

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ✓ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Etude des populations de poissons anadromes et de l'écosystème côtier à Rivière aux Saumons (Baie James)

PROJECT OBJECTIVE(S): Obtenir de l'information biologique permettant d'améliorer la capacité de donner des avis scientifiques à la gestion des poissons anadromes au Nouveau-Québec.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Baie James

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Gilles H. Tremblay Telephone: (418) 775-6593
Title: Océanographe chimiste
Address: Institut Maurice-Lamontagne
850 Route de la Mer, Mont-Joli (Québec) G5H 3Z4

1.

Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

2.

Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3.

Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals;
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of project Analyse des contaminants dans les sédiments

Project objective(s)

- Examiner la possibilité qu'il existe des endroits dans le fleuve Saint-Laurent où les contaminants s'accumulent dans les sédiments;
- Vérifier l'hypothèse qu'il n'y a pas d'accumulation nette de contaminants de provenance du fleuve St-Laurent dans l'estuaire moyen du St-Laurent mais que les contaminants s'accumulent dans les sédiments dans le Chenal Laurentien près de la tête du Chenal.

Geographic scope (circle one)

global

national

⑥ regional

local

If regional or local, what is the geographic area covered?

Fleuve St-Laurent entre le lac Ontario et Québec; estuaire moyen du St-Laurent.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Gordon Walsh Telephone: (418) 775-6577
Title: Chef intermédiaire, Division de l'Habitat du poisson
Address: Ministère des Pêches et des Océans
Dns titut Maurice Lamontagne
C. P. 1000
Mont-Joli G5H 3Z4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

La division coordonne les projets qui visent l'évaluation des effets des changements biologiques, physiques et chimiques causés par les activités de l'homme sur les ressources halieutiques et leurs habitats, le développement de technique reliée à l'évaluation qualitative et quantitative des habitats aquatiques, l'étude des effets de l'acidification de certains milieux aquatiques sur la ressource halieutique, notamment le saumon et l'importance de certains habitats pour les ressources halieutiques.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Effets sous-létaux des conditions environnementales dans le fleuve Saint-Laurent.

PROJECT OBJECTIVE(S):

- Evaluer la qualité des habitats à divers endroits du fleuve Saint-Laurent et l'état de santé des organismes qui y vivent à l'aide d'indicateurs des effets sous-létaux.
- Etablir des relations entre l'état de santé des organismes et la qualité de leur environnement.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Estuaire du Saint-Laurent, *lacs Saint-Pierre, Saint-François et Saint-Louis.*

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Analyse des contaminants présents dans le poisson de l'Estuaire moyen du Saint-Laurent.

PROJECT OBJECTIVE(S): Vérifier si la grande quantité de particules en suspension dans l'Estuaire moyen entraîne une augmentation de la contamination du poisson et de son habitat.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Estuaire moyen du Saint-Laurent

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Etude à long terme de la réponse à l'acidification des communautés biologiques de 4 écosystèmes lacustres du bouclier canadien.

PROJECT OBJECTIVE(S):

Dans le cadre du Programme national de Biomonitoring, effectuer un suivi à long terme de la réponse des communautés végétales, ichthyennes, et benthiques de quatre écosystèmes lacustres du Parc National de La Mauricie soumis à des dépôts de polluants acidifiants.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Parc National de La Mauricie

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Toxicité des fluoro-complexes d'aluminium vis-à-vis du saumon atlantique.

PROJECT OBJECTIVE(S):

Etudier la biodisponibilité et la toxicité des fluoro-complexes d'aluminium pour les juvéniles du saumon atlantique en simulant les conditions physico-chimiques printanières dans les rivières de la Côte-Nord (en collaboration avec Dr. P.G.C. Campbell de INRS-Eau).

GEOGRAPHIC SCOPE :

global
national
regional
local

If regional or local, what is the geographic area covered?:

Sans objet

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓ 9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Etude des effets sous-létaux de l'acidification printanière sur le saumon atlantique.

PROJECT OBJECTIVE(S):

Dans le cadre du Programme national de Biomonitoring, étudier les effets sous-létaux de l'acidification printanière chez des juvéniles de saumon atlantique de rivières de la côte-Nord soumises à des dépôts de polluants acidifiants.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Rivières de la Côte-Nord

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓ 9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Etudes à long terme de la réponse des communautés benthiques des rivières à saumon de la Côte-Nord face à l'acidification.

PROJECT OBJECTIVE(S):

Dans le cadre du Programme national de Biomonitoring, effectuer un suivi écologique à long terme de la réponse biologique des communautés benthiques de rivières à saumon de la Côte-Nord soumises à des dépôts de polluants acidifiants.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Rivières de la Côte-Nord

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INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓ 9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Evaluation des habitats des rivières à saumon de la Côte-Nord vulnérables à l'acidification.

PROJECT OBJECTIVE(S):

Evaluer les superficies des habitats à saumon de la Côte-Nord qui sont vulnérables à l'acidification. Etudier les effets des dépôts acides sur les variations spatiales et temporelles de la qualité des habitats du saumon atlantique sur la Côte-Nord.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Rivières de la Côte-Nord

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ✓6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; ✓
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Paléo-écologie de l'acidification récente des lacs de l'est du Canada.

PROJECT OBJECTIVE(S):

A l'aide d'une approche paléo-limnologique, évaluer les changements historiques récents (environ 200 ans) de la déposition des métaux lourds, du pH, de la productivité et de la structure des communautés phytoplanctoniques dans des lacs de l'est du Canada.

GEOGRAPHIC SCOPE :

global
✓national
regional
local

If regional or local, what is the geographic area covered?:

Québec, Terre-Neuve, Nouveau-Brunswick et Nouvelle-Ecosse

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Jean-Claude Thériault Telephone: (418) 775-6595

Title: Chef, Division de l'Océanographie, biologique

Address: Ministère des Pêches et des Océans
Institut Maurice-Lamontagne
C.P. 1000
Mont-Saint-Louis G5H 3Z4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Le programme de recherche concerne l'étude de la
nature des systèmes de production biologique et des
interrelations existant entre les diverses communautés
biologiques, leur variabilité spatiale et temporelle
à toutes les échelles et leurs relations avec les
conditions physiques et chimiques du milieu.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
- ✓9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Relations trophiques et cheminement des contaminants dans la chaîne trophique de l'estuaire du Saint-Laurent - (* Projet en phase de développement)

PROJECT OBJECTIVE(S):

Selon l'hypothèse que la zone située entre Québec et le Saguenay est une région très importante pour expliquer la dynamique de transport et de transfert des contaminants dans la chaîne trophique de l'écosystème du Saint-Laurent, un volet de l'étude portera sur les effets léthaux et sub-léthaux des contaminants sur les organismes.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Estuaire du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Communautés ichtyoplanctoniques dans le Golfe Saint-Laurent: Associations multispécifiques et interactions trophiques.

PROJECT OBJECTIVE(S):

Le projet vise à mettre en évidence les associations multispécifiques de l'ichtyoplancton dans le Golfe Saint-Laurent. Dans un premier temps, l'analyse de données historiques sera faite afin de vérifier les hypothèses suivantes: 1) l'ichtyoplancton estival du sud-ouest du Golfe est composé de différents assemblages multispécifiques dont les répartitions géographiques sont stables dans le temps, 2) les variations interannuelles de la structure des différentes communautés sont spatialement synchrones. La seconde phase du projet étudiera l'effet des facteurs physiques et biologiques sur la distribution et l'hétérogénéité verticale de certaines communautés d'oeufs et larves de poissons.

GEOGRAPHIC SCOPE :

global
national
✓regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.

INDICATOR RESEARCH PROJECT DESCRIPTION

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ✓ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

NAME OF PROJECT: Alimentation et distribution de larves de Sébaste par rapport à la productivité du copépode planctonique, Calanus finmarchicus.

PROJECT OBJECTIVE(S):

To test the hypothesis that the spatial-temporal distribution of redfish larvae in the Gulf of St. Lawrence is directly related to the production cycle of the planktonic copepod, Calanus finmarchicus.

GEOGRAPHIC SCOPE :

global
national
✓ regional
local

If regional or local, what is the geographic area covered?:

Golfe du Saint-Laurent.



Fisheries
and Oceans

Pêches
et Océans

Bayfield Institute
867 Lakeshore Road
P.O. Box 5050
Burlington, Ontario
L7R 4A6

Institut Bayfield
867 chemin Lakeshore
C.P. 5050
Burlington (Ontario)
L7R 4A6

Your file / votre référence

Our file / Notre référence

25 October 1989

SHEEHY

Mr. Greg Sheehy
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

I received your request for program information. Unfortunately, there is not enough time to describe our projects one by one for your questionnaire. I am enclosing a copy of our 1988/89 Project Forecasts. I am sure they contain more than enough information.

If you require more, please give me a call at 416-336-4862.

Sincerely,

B. Lyon

for: Vic Cairns
Manager
Fish Habitat Studies Division

cc: John Fitzsimons

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(i)
CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTE

~~ECT NO:~~ 4547

PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION: Burlington COLLATOR: 2945
BRANCH: Physical and Chemical Sciences COST CODE #: 4547
LABORATORY: Great Lakes Laboratory for Fisheries and Aquatic Sciences
DIVISION: Fish Habitat Studies
PROJECT TITLE: Benthic Habitat Concerns, Bay of Quinte and Eastern Lake Ontario
PROJECT LEADER: R. Dermott TELEPHONE: (416) 336-4868
PROJECT MEMBERS:

ANCILLARY RESOURCE INFORMATION

NWRI mainframe Cyber computer 0.8 cpus
Tech ops equipment: Benthos corer, Ponar
Water Quality : 31 samples, sediment organic content

OBJECTIVES:

- 1) To determine the reestablishment of burrowing mayfly habitat in the upper Bay of Quinte.
 - 2) To determine the seasonal trends in littoral macro and mesobenthic fauna in the upper Bay of Quinte and the relative habitat association of the dominant fauna.
 - 3) To examine the reproductive success of the lower Bay of Quinte Pontoporeia populations as an early warning indicator of habitat deterioration. in eastern Lake Ontario.
 - 4) To determine the depth distribution of Pontoporeia in the lower Bay of Quinte; to test if the YOY are separated from the adults.
 - 5) To determine if the amphipods are feeding intermittently, with the majority of their energy reserves (and contaminants) being accumulated during a brief 2 month period during the spring diatom bloom.
-

RATIONALE/JUSTIFICATION:

- 1) The IJC has requested the development of a Remedial Action Plan (R.A.P.) for the Bay of Quinte, one of the IJC's Areas of Concern due to eutrophication. Restoration of the habitat and rehabilitation of the warm water fisheries is a major goal of cleanup efforts. Benthic sampling toward understanding the effects of reduced phosphorus loading has been undertaken in the lower portion of the bay since 1977 at the expense of the inshore areas and shallow upper bay. Clients of Project Quinte (OMNR, OME) have stressed the lack of data on the role and availability of shallow benthos to fish diets of the bay. Recent data (1987) indicate that a population of the mayfly Hexagenia has reappeared in the upper bay near Belleville, where the species has been absent for over 30 years.
- 2) Lake Ontario populations of the amphipod, Pontoporeia have very high levels of lipid and contaminants which are passed on to lake trout when preyed upon. The survival of Pontoporeia is being used as the habitat indicator of clean environments in the 1987 GLWQA. Reproductive success has been shown to be greatly reduced under the influence of trace contaminant levels. The reproductive potential and survival of young can be easily measured by the number and survival of young produced each spring.

CURRENT YEAR MILESTONES/EXPECTED OUTPUTS:

PLANNING YEAR MILESTONES/EXPECTED OUTPUTS: (Proposed/Approved)

Assess the current mayfly distribution and habitat requirements in the upper Bay of Quinte.

Assess the seasonal and diurnal feeding cycles of Pontoporeia in the lower bay, and reproductive success of the population.

Assess the littoral benthic populations and habitat requirements of major species.

WORKLOAD FACTORS:

Launch availability May 19 to June 1, Aug 1 to Aug 15, 1988.

Inclimate weather during allotted sample dates.

Contract for data completion delay till March 1989.

Resources for summer technical assistance.

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CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTEPROJECT NO: 4541PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION:	<u>Burlington</u>	COLLATOR:	<u>2945</u>
BRANCH:	<u>Physical and Chemical Sciences</u>	COST CODE #:	<u>4541</u>
LABORATORY:	<u>Great Lakes Laboratory for Fisheries and Aquatic Sciences</u>		
DIVISION:	<u>Fish Habitat Studies</u>		
PROJECT TITLE:	<u>Slimy Sculpin Tumor Monitoring</u>		
PROJECT LEADER:	<u>Mr. J.D. Fitzsimons</u>	TELEPHONE:	<u>(416)336-4862</u>
PROJECT MEMBERS:			

ANCILLARY RESOURCE INFORMATION

RATIONALE/JUSTIFICATION:

Many of the liver tumors in Great Lakes fishes show a putative association with chemical contaminants. In Lake Ontario, the most contaminated Great Lake, contaminants are dispersed across all depths of the lake. The white sucker, a species which shows localized increases in liver tumor frequency around the lake, integrates a relatively small portion of the lake since it is restricted to depths of generally less than 15 m. Tumor occurrence in suckers is confounded by an apparent ubiquitous chronic proliferative cholangiohepatitis and cholangolar neoplasia in control populations. In contrast, in Lake Ontario the sculpin occurs at depths ranging from 35 to 150 m. with some populations having a 0% tumor prevalence. Also, Lake Ontario slimy sculpins are contaminated with PCBs, DDT and dioxins. and are the most important food source for juvenile lake trout.

CURRENT YEAR MILESTONES/EXPECTED OUTPUTS:

Approximately 600 livers have been examined for liver anomalies. Since this work indicated that tumors were both age and spatially dependant, another 400 samples will be examined in 88/89. High tumor frequency in sculpins ranging up to 5.8%, occurred at the same sites as for white suckers, and included both

(i)

CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTEPROJECT NO: 2107PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION:	<u>Burlington</u>	COLLATOR:	<u>2921</u>
BRANCH:	<u>Physical and Chemical Sciences</u>	COST CODE #:	<u>2107</u>
LABORATORY:	<u>Great Lakes Laboratory for Fisheries and Aquatic Sciences</u>		
DIVISION:	<u>Ecotoxicology</u>		
PROJECT TITLE:	<u>Biochemical Indicators Of Chemical Effects On Fish</u>		
PROJECT LEADER:	<u>P.V. Hodson</u>	TELEPHONE:	<u>(416) 336-4864</u>
PROJECT MEMBERS:	<u>K. Ralph, B. Gray, J. Carey</u>		

ANCILLARY RESOURCE INFORMATION

DFO Ultratrace Lab. - 32 analyses of fish tissues - organics
ENV. Can, IWD - analyses of 128 samples of fish for metals.
DFO Ships - Shark and small boats

OBJECTIVES:

1. To develop reliable and practical assays for biochemical and physiological responses of fish that are indicative of chemical exposure and effects.
 2. To adapt these assays for routine use in biological surveillance of chemical effects in Great Lakes fish.
 3. To verify the utility of these tests through field experiments and surveys that relate responses to chemical exposure (e.g. location or proximity to chemical sources; levels of chemicals in water, sediment or diet; levels of chemicals in fish tissues; levels of chemical metabolites in fish tissues)
 4. To identify chemicals that cause biochemical and physiological responses of Great Lakes Fish.
-

RATIONALE:

Laboratory measurements of the toxicity of chemicals to aquatic biota are the basis for water quality objectives. However, compliance with objectives may not protect biota from the interactive toxicity of mixtures or the effects of unknown or unmeasured chemicals. To ensure the validity of objectives, and to identify potential chemical problems in Great Lakes fisheries, this project will measure the degree of exposure of fish to chemicals through assays of characteristic biochemical and physiological responses. This project is currently testing the hepatic mixed function oxidase (MFO) activity and metallothionein (MT) levels of fish. MFO activity is a measure of the rate of

RATIONALE: (Continued)

detoxification of aromatic chemicals; its elevation is associated with carcinogenicity and reproductive failure in fish. MT is a protein synthesized in response to heavy metals. It has a strong binding affinity for metals and may act as a detoxification mechanism. In theory, when synthesis of MT is maximal, further metal exposure results in toxicity. Development of these assays will address research needs for biological monitoring, polynuclear aromatic hydrocarbons (PAH), metal contamination, and fisheries rehabilitation (Hamilton Harbour) of the GLSAB, GLFC, the GLWQP chemical priority list and the 1978 Agreement on Great Lakes Water Quality. This project is related to projects 2106 (QSAR), 2109 (Hamilton Harbour), 4541 (Tumours in fish), 4524 (Lake trout physiology), 2111 (Contaminants surveillance), and 4506 (metals in soft, acid waters)

CURRENT YEAR MILESTONES/EXPECTED OUTPUTS

1. Experiment to compare the AHH activity of lake trout to levels of PAH, PAH metabolites, and chlorinated hydrocarbons in populations demonstrating normal and failed reproduction (with Dr. John Carey, ECD, NWRI) (partially complete)
2. Completion of MS describing the AHH activity of white suckers in Lake Ontario (in progress);
3. Experiments to measure the AHH activity of native and laboratory fish after exposure to Hamilton Harbour water and sediment, either in situ or in the laboratory, and to compare this response with their chemical exposure and contamination (with Dr. John Carey, ECD, NWRI) (partially complete);
4. Completion of analysis of MT samples from 1986/87 lab experiments (complete);
5. Preliminary experiment to compare the MT and metal levels of fish from metal-contaminated and clean areas of the Great Lakes and of off-system lakes (with Dr. George Dixon, U. of Waterloo) (in progress);
6. Experiments to compare tissue MT levels by the polarographic and metal saturation techniques. This will involve the trading of samples with Dr. Jack Klaverkamp, FWI (in progress);
7. Further refinements of the analytical method for MT and addition of metals analyses and measurements of effects associated with non-complexed metals. This will be a test of the 'spillover' hypothesis (in progress).

PLANNING YEAR MILESTONES/EXPECTED OUTPUTS

1. Measurements of the activity of two MFO enzymes (arylhydrocarbon hydroxylase (AHH) and ethoxyresorufin-o-deethylase (EROD)) and levels of MT in tissues of lake trout and white sucker along gradients of contamination. These will include:
 - a. a gradient induced in the offshore part of the Great Lakes by both industrial discharges and LRTAP, comprising Lakes Superior, Huron, Erie, Michigan and Ontario;
 - b. a gradient induced in the inshore part of Lake Ontario by industrial discharges in Hamilton Harbour, Toronto Harbour and the Bay of Quinte;

CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTEPROJECT NO: 2109PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION: Burlington COLLATOR: 2921
BRANCH: Physical and Chemical Sciences COST CODE #: 2109
LABORATORY: Great Lakes Laboratory for
Fisheries and Aquatic Sciences
DIVISION: Ecotoxicology
PROJECT TITLE: Hamilton Harbour Rehabilitation - Contaminants Assessment
PROJECT LEADER: P.V. Hodson TELEPHONE: (416) 336-4864
PROJECT MEMBERS: B. Gray

ANCILLARY RESOURCE INFORMATION

DFO Ultratrace Lab. - 10 fish and 5 sediment samples for organic contaminants.

OBJECTIVES

1. To determine whether chemical contamination of Hamilton Harbour is a barrier to the rehabilitation of the fishery.
2. To determine the effects of nutrient limitations on chemical contamination and toxicity to fish.

RATIONALE

DFO's fish habitat policy identifies the need and responsibility to maintain and restore habitat, and this corresponds to the research and management needs of the GLFC and the IJC to restore degraded ecosystems and fisheries in Great Lakes "areas of concern".

Hamilton Harbour once sustained an extremely valuable cold and warm water fishery that contributed significantly to fish production in western Lake Ontario. Rapid municipal and industrial expansion caused the disappearance of this fishery and a change in the species composition and total productivity of the Harbour. The stresses that have contributed to the decline in the fishery include major changes in physical habitat, chemical contamination and introduction of exotic species. This project will address the problems of chemical contamination and is related to project 2107, 4541, and 4543.

CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTEPROJECT NO: ~~4553~~PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION: Burlington COLLATOR: 2945
BRANCH: Physical and Chemical Sciences COST CODE #: 4553
LABORATORY: Great Lakes Laboratory for
Fisheries and Aquatic Sciences
DIVISION: Fish Habitat Studies
PROJECT TITLE: Long Term Biological Program - Lake Ontario
PROJECT LEADER: Dr. O.E. Johannsson TELEPHONE: (416)336-4708
PROJECT MEMBERS:

ANCILLARY RESOURCE INFORMATION

Technical operations support is required from April 4th until October 28 to prepare the Bayfield at the beginning of the season, participate in the cruises and unload the ship again in the autumn.

Main frame computing facilities are required through out the year for data analysis and storage of star file data generated by the program.

Drafting facilities are required for the production of slides for presentations.

Water chemistry requirements are covered by IWD

OBJECTIVES:

BASIC PROGRAM

1. Long term monitoring of the open water biotic community to detect changes in community structure, biomass, productivity, timing of temporal events and indicator species.
2. To establish the ranges of normal annual variability within the system against which to judge changes.
3. To provide annual estimates of zooplankton, mysid and amphipod productivity.

OBJECTIVES: (Continued)

4. To improve estimates of zooplankton productivity by incorporating patterns of diurnal vertical distribution with respect to temperature and light, and seasonal estimates of species dry weights, and by converting from epilimnetic net samples to 0-30 m pump samples to estimate population size.
5. To determine the statistical confidence around seasonal zooplankton production estimates.
6. To determine if the lack of small amphipods in the spring-early summer samples is due to sampling problems with the Ponar or to a difference in the vertical distribution of the young in the water column.

PROGRAM RELATED RESEARCH

The Bioindex program is an experimental monitoring program. In addition to the basic monitoring described above the program was designed to investigate the functional relationships between trophic levels. This information would provide an understanding of the mid-lake ecosystem and determine the most appropriate biological variables to be maintain in a monitoring program.

1. To determine seasonal estimates of primary production and determine the relative importance between years and throughout the season that factors such as transparency, solar irradiance, mixed depth, phosphorus availability and zooplankton grazing pressure have in determining the level of production.
 2. To examine possible food limitation of zooplankton species by estimating the lipid/ovary index through the season and by examining the relationship between primary productivity, phytoplankton density and zooplankton community grazing pressure.
 - 3a. To continue to develop and evaluate different statistical methods for long term biological monitoring. Some comparisons of zooplankton population dynamics in Lake Ontario and ELA lakes using the same statistical methods have been planned co-operatively with Dr. D. Malley (Freshwater Institute).
 - 3b. To investigate the sensitivity of zooplankton population characteristics which could be used to indicate the intensity and type of predation pressure or sufficiency of food supply, and to determine the ranges in these parameters associated with annual variability.
 4. To complete work on amphipod feeding rates by evaluating the importance of any diurnal feeding pattern.
-

(i)

CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTE~~PROJECT NO:~~ ~~4548~~PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION: Owen Sound COLLATOR: 2945
BRANCH: Physical and Chemical Sciences COST CODE #: 4548
LABORATORY: Great Lakes Laboratory for
Fisheries and Aquatic Sciences
DIVISION: Fish Habitat Studies
PROJECT TITLE: Zooplankton and Larval Whitefish in Lake Huron
PROJECT LEADER: Dr. M.G. Johnson TELEPHONE: (519) 371-0040
PROJECT MEMBERS:

ANCILLARY RESOURCE INFORMATION

Total of 55 water samples for nutrients (TP, SRP, TKN, NM_3 , NO_3NO_2 , SiO_2) and major ions (Ca, Mg Na, K, SO_4 , Cl).

OBJECTIVES:

To characterize inshore habitat conditions in areas of Lake Huron and Georgian Bay, develop trend-in-time data on selected environments, and to use the data base in evaluating habitat classification schemes.

To develop trend-in-time data on zooplankton abundance in southern Georgian Bay and central, inshore Lake Huron, and to examine relationships between whitefish and lake herring year-class strength and abundance of zooplankton and quality of food supply (i.e. species, sizes, distribution, etc.) and limnological conditions.

RATIONALE/JUSTIFICATION:

We should develop our understanding of fish habitat on a functional, as opposed to descriptive, basis. It appears that good nursery habitat for whitefish and other species may be the most limited and most vulnerable of all of the types of habitat needed by whitefish.

Production and well-being of fish stocks may be related to limnological conditions at some early life-history stage. One current hypothesis on year-class strength (of whitefish) is that this is established soon after egg hatching and emergence by availability of readily utilizable zooplankton feed. It is important to relate limnological work to practical problems of fisheries management.

(i)
CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTE

PROJECT NO: 4502PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION: Sault Ste. Marie COLLATOR: 2945
BRANCH: Physical and Chemical Sciences COST CODE #: 4502
LABORATORY: Great Lakes Laboratory for Fisheries and Aquatic Sciences
DIVISION: Fish Habitat Studies
PROJECT TITLE: LRTAP - Turkey Lakes Calibrated Watershed and Biomonitoring
PROJECT LEADER: Dr. J.R.M. Kelso TELEPHONE: (705) 942-2848
PROJECT MEMBERS:

ANCILLARY RESOURCE INFORMATION

- ATV's, boats from Tech. Ops. support to Turkey Lakes Watershed

OBJECTIVES:

To monitor the temporal response of biota to changes in atmospheric transport of pollutants in one (Turkey Lakes Watershed) of 5 DFO national monitoring sites.

To determine the factors controlling the success of brook trout in lakes sensitive to atmospheric deposition.

To determine the factors (buffer status, nutrient delivery, morphometry) controlling standing stock and production of biota in an oligotrophic, acid-sensitive watershed.

RATIONALE/JUSTIFICATION:

Sulphur emitting provinces have voluntarily adopted a reduction strategy to be in place by 1994; however, the U.S. has as yet failed to implement an emission control strategy. Canada (both federal and provincial governments) have implemented a joint strategy to monitor changes in, particularly, endemic fish stocks and sensitive biota. DFO entered the partnership by focussing its monitoring program on the calibrated watersheds one of which is the Turkey Lakes watershed.

In the Turkey Lakes watershed, operated co-operatively by DOE, DFO and D.Agr. in a cost-sharing and data sharing arrangement, we are:

- 1) monitoring responses of biological communities in a region where deposition varies from 20 to 37 kg ha⁻¹ y⁻¹ wet sulphate (data from 1976 - present);

RATIONALE/JUSTIFICATION: (Continued)

- 2) determining factors, particularly of atmospheric origin, that control production levels;
 - 3) testing new procedures for stock assessment and ecosystem health assessment, and
 - 4) evaluating the success of brook trout introduced to an acid sensitive environment.
-

CURRENT YEAR MILESTONES/EXPECTED OUTPUTS:

1. 23 manuscripts have been peer reviewed and accepted (11/23 as of 01/12/87) for publication in Can. J. Fish. and Aquat. Sci. Spec. Pub. One 1988.
 2. DFO biomonitoring protocol implemented 1987/88.
 3. Performed net comparisons in reciprocal Mill-FWI/Kelso-GLLFAS arrangement.
 4. Conducted blood sampling and chemical analysis with Klaverkamp-FWI to evaluate blood parameters as stress indicators.
 5. Performed abundance estimates of brook trout in Batchawana Lakes. There are now introduced fish plus 1986 progeny.
 6. Conducted acoustic estimates day and night in spring (2X) summer (2X) and fall (1X)
 7. Tracked brook trout and white sucker in 2 lakes. Some fish caught by anglers and 2 transmitters lost but data good for remaining fish.
-

PLANNING YEAR MILESTONES/EXPECTED OUTPUTS: (Proposed/Approved)

1. Analyze samples and data from year 1 of biomonitoring program.
2. Use acoustics to evaluate pelagic biomass (invertebrates plus fish) and compare to traditional estimates.
3. Evaluate methods for benthic sampling used in biomonitoring protocol and compare with past collections (Dermott).
4. Continue brook trout assessment (routinely sample invertebrates/food, M-R estimate of brook trout).
5. Expand collections and analysis of blood parameters (with Klaverkamp).
6. Explore with DOE the installation of other lake monitoring sites.
7. Develop synthesis of results from research in the watershed.

(i)

CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTE~~PROJECT NO:~~ 2110PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION:	<u>Burlington</u>	COLLATOR:	<u>2921</u>
BRANCH:	<u>Physical and Chemical Sciences</u>	COST CODE #:	<u>2110</u>
LABORATORY:	<u>Great Lakes Laboratory for Fisheries and Aquatic Sciences</u>		
DIVISION:	<u>Ecotoxicology</u>		
PROJECT TITLE:	<u>Biochemical indicator in aquatic organisms: adenine nucleotides.</u>		
PROJECT LEADER:	<u>P.T.S. Wong</u>	TELEPHONE:	<u>(416) 336-4559</u>
PROJECT MEMBERS:	<u>S. Rhamey, (Y.K. Chau - DOE)</u>		

ANCILLARY RESOURCE INFORMATION

- Water Quality National Laboratory support for the analyses of 100 water samples for trace metals, Al, POC, PN, DOC, nitrogen, phosphorus, alkalinity, conductivity and hardness.
- Microbiology for the use of autoclave and glass-distilled water.
- Mainframe computer for time and advice on bibliography filing system.
- Drafting service for slides and figures.
- Vessel and vehicle support requested through Dr. Chau (NWRI, DOE).

OBJECTIVES:

To develop a high pressure liquid chromatography (HPLC) technique for measuring adenine nucleotides in clams and to use this technique to evaluate the "health" of clams and algae in areas polluted with tributyltin compound.

RATIONALE/JUSTIFICATION:

With an increase in the large number of toxic chemicals being discharged into the aquatic environment, there is an urgent need to develop biochemical techniques that can be conveniently and universally used to assess the responses of all the organisms to the chemical stresses. The 3 adenine nucleotides along with their ratio, adenylate energy charge, have been proposed to be one of the techniques. This project is relevant to the issues of ecosystem health and biomonitoring techniques in the 1986/87 Toxic Chemicals Issues and Priorities (Great Lakes Toxic Chemicals Committee, Sept. 1986). The 1987 Great Lakes Science Advisory Board Report to the International Joint Commission also recommends continuing the research on clinical and biochemical measurements of stress in the biota.

(1)

CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTEPROJECT NO: 2113PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION: Burlington COLLATOR: 2921
BRANCH: Physical and Chemical Sciences COST CODE #: 2113
LABORATORY: Great Lakes Laboratory for
Fisheries and Aquatic Sciences
DIVISION: Ecotoxicology
PROJECT TITLE: Rapid Toxicity Testing of Contaminants Associated with Sediments
and Effluents in the Great Lakes.
PROJECT LEADER: M. Munawar TELEPHONE: (416) 336-4867
PROJECT MEMBERS: L. McCarthy

ANCILLARY RESOURCE INFORMATION:

- From DOE:
1. chemical analysis from National Water Quality Lab
 2. operation of equipment from Technical Operations
 3. mainframe computer help
 4. drafting services
-

OBJECTIVES:

1. Assess bioavailability and toxicity of contaminants to biota, originating from bottom sediments and suspended particulate matter in the Great Lakes.
 2. Develop a battery of tests at several trophic levels for the assessment of impact of contaminants on the biota in the Great Lakes Areas of Concern to facilitate implementation of Remedial Action Plans for the decontamination of the Great Lakes.
 3. Continue modification of in situ plankton cages.
 4. To develop and modify toxicity testing equipment for rapid and in situ assessment of contaminants stress.
-

RATIONALE/JUSTIFICATION:

1. To facilitate implementation of Fisheries and Oceans' research and monitoring responsibilities under the revised Canada/USA Great Lakes Water Quality Agreement.
2. Contribute scientific effort to CODE activities within Central and Arctic Region.
3. The Annex on contaminated sediments in the 1987 Great Lakes Water Quality Agreement necessitates the identification of contaminated sediment problem areas, assessment of environmental impact and development of Remedial Action Plans.

CENTRAL AND ARCTIC REGION
BAYFIELD INSTITUTEPROJECT NO: ~~2111~~PROJECT REVIEW: 1987/88
PROJECT PLANNING: 1988/89

LOCATION:	<u>Burlington</u>	COLLATOR:	<u>2921</u>
BRANCH:	<u>Physical and Chemical Sciences</u>	COST CODE #:	<u>2111</u>
LABORATORY:	<u>Great Lakes Laboratory for Fisheries and Aquatic Sciences</u>		
DIVISION:	<u>Ecotoxicology</u>		
PROJECT TITLE:	<u>Great Lakes Contaminants Surveillance</u>		
PROJECT LEADER:	<u>D.M. Whittle</u>	TELEPHONE:	<u>(416) 336-4565</u>
PROJECT MEMBERS:	<u>W. Hyatt, M. Keir</u>		

ANCILLARY RESOURCE INFORMATION

- DOE (NWQL) - Trace metal analyses of fish tissue homogenates and invertebrate samples.
 - DOE (Drafting) B & W Drawings.
-

OBJECTIVES:

1. To describe trends in burdens of toxic contaminants in representative Great Lakes top predator and forage fish species together with major invertebrate dietary items.
 2. To identify the significance of recently detected priority contaminants and to describe the potential to impact on the fishery resources of the Great Lakes.
-

RATIONALE/JUSTIFICATION:

Annex 11 and 12 of the 1978 Canada/U.S. Great Lakes Water Quality Agreement require that surveillance and monitoring activities be undertaken to assess the effectiveness of remedial measures by measuring the temporal and spatial trends of persistent toxic substances. The Third Biennial Report by the IJC also recommended that the implementation of the current Surveillance Plan was critical to the interests of both countries.

Under the requirements of the IJC plan, the GLLFAS surveillance program is also charged with the responsibility of identifying emerging problems by determining the presence of hitherto undetected contaminant problems in the Great Lakes. The measurement of contaminant burdens in various fish species and their forage base is consistent with this charge and aids in defining the impact of contaminants on the fishery resource.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Ken T. J. Chang-Kue Telephone: (204) 983-5123
Title: Resource Impact / Habitat Biologist
Address: FRESHWATER INSTITUTE

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

MY FIELD RESEARCH INVOLVES COLLECTING DATA ON THE BIOLOGY OF SELECTED ARCTIC FISH SPECIES, ESPECIALLY THE COGONID (WHITISH) IN THE MACKENZIE RIVER / BEAUFORT COASTLINE REGION. FISH LIFE HISTORY IS REQUIRED BY D.F.O. IN ITS MANDATE TO PROTECT FISH & FISH HABITAT. THE DATA IS PUBLISHED IN IN-HOUSE TECHNICAL REPORTS, WORKSHOPS AND SCIENTIFIC LITERATURE. INFORMATION ON FISH ^{HAS} BEEN USED IN IMPACT ASSESSMENT AND RECOMMENDATIONS TO INDUSTRIAL DEVELOPMENT PROGRAMS IN THE MACKENZIE VALLEY ~~STATION~~ AND IN THE YELLOWKNIFE DISTRICT SINCE 1972.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

COASTAL COREGONID MIGRATIONS.

Project objective(s)

- ① BY FISH SURVEY TECHNIQUES, IDENTIFY THE LIFE HISTORY STAGES OF FISH IN AN AREA
- ② USING FLOY TAGS AND RADIO-TELEMETRY, IDENTIFY THE MOVEMENT ~~BEHAVIOR~~ PATTERNS, MIGRATION ROUTES AND MIGRATION TIMING OF THE FISH POPULATION INVOLVED.
- ③ EVALUATE THE IMPACT OF INDUSTRIAL DEVELOPMENT PROJECTS ON THE FISH POPULATIONS.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Lower Mackenzie River, Mackenzie Delta, on Tuktoyaktuk Peninsula and the Coastal Zone between Anderson River and Herschel Island.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: R. Clarke

Telephone: 5182

Title: Manager, Regulatory & Native Affairs

Address: Department of Fisheries & Oceans

501 University Ave

Winnipeg

R3T 2N6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

N/A

Provide advice & lead the Planning Commission

NWT & Yukon North Slope as important projects

regional & national level

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

N/A

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

R. Moshenko

J. Stein

R. Allen

V. Gillman

D. Moshenko

H. Shear

D. Topolinski

Suine

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Project 1: Air Quality in the
Planning Commission in NWT in 1980

Project objective(s)

Provides an overview of the state of the environment in the NWT and identifies the major environmental issues. Takes information from other sources and integrates it into a regional overview.

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

NWT in Yukon NWT Shores

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

(201)

Your Name: Raymond Heeslein Telephone: 983 5251
Title: Section leader, Experimental Limnology
Address: Freshwater Institute Fisheries + Oceans Canada
501 University Crescent, Winnipeg, Man. R3T2N6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

To describe and understand the whole ecosystem
response of lakes and their watersheds to natural
and man-made perturbations.

Data is published in primary journals and used
in devising management strategies for aquatic
ecosystems.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ⑨ exposure of fish and wildlife to toxic chemicals.

Name of Project

whole lake acidification studies and
recovery from acid conditions.

Project objective(s)

To document and investigate
the effect of acidification of lakes on ~~the~~ health of
organisms, populations, species composition, productivity.
To test the reversibility of ~~these~~ in the recovery
from acidification including invasion by species
which were not present or had disappeared

Geographic scope (circle one)

global

national

⑧ regional

local

If regional or local, what is the geographic area covered?

Canadian shield esp. Northwestern Ontario

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
3. contaminant levels in food; or
- ⑨ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Wet land acidification studies

Project objective(s)

To determine the effects of high atmospheric loading of sulfuric acid, nitric acid, and ammonia on wetlands, including plant growth and speciation, peat decomposition, insect emergence.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

done in northwestern Ontario but applicable to many areas of wetlands in Canada

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Whole lake Cadmium study

Project objective(s)

To determine the physiological and population impacts of low levels of Cd in lakes (100 ng/L). To determine the accumulation of Cd in aquatic organisms.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

Done in NW Ontario applicable to Canadian Shield.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ⑨ exposure of fish and wildlife to toxic chemicals.

Name of Project

Using stable isotopes of carbon, nitrogen, and sulfur as indicators of food web structure and migration patterns of fish.

Project objective(s)

To determine the food web structure, sources of food and migration patterns of fish in large rivers and estuaries using the powerful tool of stable isotope analyses.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

McKenzie Delta, NW Ontario, arctic coastal rivers and lakes.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
- ③ rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Food chain manipulation studies -
top predator introduction

Project objective(s)

To determine the effect on
food chains leading to fish by introduction
of a top predator.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Done in NW Ontario, applicable to all aquatic
systems

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: A.H. KRISTOFFERSON Telephone: (204) 983-5159
Title: FISHERY MANAGEMENT BIOLOGIST
Address: 501 UNIV. CRES.
WINNIPEG, MB
R3T 2N6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

- to identify and determine status of stocks of
Arctic char along the coastal Yukon and
Northwest Territories.
- to monitor response of above to current level of exploitation
- indicator data are used to recommend sustainable
levels for commercial, sport and subsistence
fisheries for above species.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

J. B. Simpson
Department of Fisheries and Oceans
Northwest Atlantic Fisheries Centre
St. John's, Nfld.

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

*Lish and Marine Mammal Management
Coastal Fisheries*

Project objective(s)

*- to identify discrete stocks of Arctic char
- to determine effects of current levels of exploitation on same
- to conduct studies on distribution and abundance where necessary
- to recommend safe levels of harvest for
commercial, sport and subsistence fisheries for Arctic char*

Geographic scope (circle one)

global
national
☒ regional
local

If regional or local, what is the geographic area covered?

- coastal Yukon and Northwest Territories.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. J. Reist

Telephone: (204) 983-5032

Title: Section Head, Arctic Fish Ecology and Assessment Research

Address: Fisheries and Oceans
501 University Crescent
Winnipeg MB R3T 2N6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Item 2 in the list; in part item 4.

General purpose is to develop appropriate data bases on the genetic structure, dynamics and abundance of selected anadromous and marine fish populations in the Canadian Arctic over the long-term (i.e. 10+ years) with the view to understanding of effects of natural variability and human impact (exploitation, environmental change, etc) and the ability and mechanisms by which fish populations respond over time to impacts. This is designed to achieve knowledge to allow for sustainable yields associated with fisheries.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

Inappropriate at this time due to the recency of Section organization and the preliminary nature of some programs.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

- ① production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ⑨ exposure of fish and wildlife to toxic chemicals.
- ⑩ levels of contaminants in biota not habitually consumed by man.

Name of Project

NANISIVIK & POLARIS MINE MONITORING PROGRAM

Project objective(s)

TO STUDY CHANGES IN THE CONCENTRATIONS
OF LEAD, ZINC & CADMIUM IN SEDIMENTS, SEaweeds & BIVALVE
MOLLUSCS IN THE VICINITY OF THE NANISIVIK AND POLARIS MINES
TO DETERMINE THE ULTIMATE ZONE OF IMPACT, TO ATTEMPT TO DETERMINE
THE METAL CONCENTRATIONS WITHIN ORGANISMS AT WHICH ~~THE~~ ADVERSE
EFFECTS UPON ORGANISMS BECOME APPARENT, WITH A VIEW TO USING
BODY BURDEN METAL CONCENTRATIONS AS INDICATORS OF THE STATE OF
ENVIRONMENTAL HEALTH IN THE VICINITY OF BASE METAL MINES.

Geographic scope (circle one)

global
 national
 regional
 local

If regional or local, what is the geographic area covered?

MAINE WATERS IN THE VICINITY OF NANISIVIK AND POLARIS, N.W.T.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Pierre Richard Telephone: (204) 983-5162
Title: Marine Mammal Management Biologist
Address: Fisheries and Oceans, 501 University Crescent
Winnipeg Man. R3T2N6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Our mandate is to assess arctic marine
mammal populations that are used by
northerners and recommend on management
of the harvest and habitat regulation
if need be.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Assessment of beluga, narwhal
and walrus populations (distribution and abundance)
in relation to their use.

Project objective(s)

as state in title of project

Geographic scope (circle one)

global
national
③ regional
local

If regional or local, what is the geographic area covered?

NWT and Quebec (northern) waters

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK
SURVEY QUESTIONS

Dr. R. Stewart

(204) 983-5023

Section Leader, Arctic Marine Mammal Ecology and Assessment
Research

Department of Fisheries and Oceans, Freshwater Institute,
501 University Crescent, Winnipeg, Manitoba, R3T 2N6

1. Our Section does not carry out what would be described as Indicator Research. Rather we attempt to identify and understand natural processes relevant to Arctic marine mammals. While some of these investigations provide data on such things as distribution and reproduction, we do not monitor these parameters on a regular basis. Moreover, changes in these parameters in marine mammals are poor indicators of environmental change which is most often filtered through several other trophic levels first. Our research supports the activities of the Fish and Marine Mammal Management Section here, which has the mandate for population harvest and recruitment monitoring.

2. Although we are not doing indicator research, I have briefly outlined our main projects on the next page.

3. R. Moshenko, Fish and Marine Mammal Management, Department of Fisheries and Oceans, Freshwater Institute, 501 University Crescent, Winnipeg, Manitoba, R3T 2N6

Project Summary
Research

Arctic Marine Mammal Ecology and Assessment

Genetics - Using enzyme electrophoresis and newer RNA and DNA techniques, this is an investigation into the evolutionary history of arctic marine mammal species and an attempt to identify genetic stocks or populations within species.

Lipid Physiology - This research is examining ways of determining food habits of arctic marine mammals by matching fatty acid profiles in predators and prey. It also seeks to understand internal lipid dynamics.

Productivity - Applying energetic, morphometric and behavioural techniques, this study investigates the interactions which affect growth and reproductive success.

Population Biology - This is an examination of factors influencing estimates of population abundance including methodological approaches and biological parameters. The former encompasses technical devices to enhance detecting and counting marine mammals as well as survey design and statistical inference. The latter investigates topics such as distribution and migration.

Acoustics - Using sophisticated computerized data collectors and analyzers, this research attempts to identify and quantitatively describe the sounds produced by arctic marine mammals. Results are applied to problems of basic animal behaviour, anthropogenic noise and the identification of marine mammal populations.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: J.T. Strong

Telephone: 204-983-3392

Title: Marine Mammals Management Biologist

Address: Fisheries and Oceans Canada, 501 University Cresc.,
Winnipeg., Manitoba, R3T 2N6

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).

The 2 projects provide data for management decision-making regarding
allowable harvest levels and critical habitat. The data is also used
to plan other projects.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?
-

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 - ☒ 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 - ☒ 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Beaufort Sea Beluga Project

Project objective(s): To determine the abundance and the distribution of the Beluga stock while it is in the Canadian Beaufort Sea.

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Canadian Beaufort Sea south of the permanent pack ice, and Amundsen Gulf

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Lancaster Sound Narwhal Project

Project objective(s): To determine the abundance and distribution of narwhal in the Canadian high arctic: Eclipse Sound/Navy Board Inlet, Admiralty Inlet, Prince Regent Inlet and Peel Sound.

Geographic scope (circle one): global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Eclipse Sound/Navy Board Inlet, Admiralty Inlet, Prince Regent Inlet, Peel Sound

INDICATOR RESEARCH PROJECT DESCRIPTION

Polina
Project #13

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ④ quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

High Arctic coastal fisheries for Arctic
charr

Project objective(s)

To develop and implement strategies for the effective
management of Arctic charr stocks in the Canadian
High Arctic.

Geographic scope (circle one)

global

national

① regional

local

If regional or local, what is the geographic area covered?

Canadian High Arctic - north Baffin Island in particular
for 1989/90.

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Monitoring of the Lancaster Sound
narwhal hunt

Project objective(s)

To collect catch/effort data on the subsistence
narwhal hunt in the Lancaster Sound area to
determine hunting pressure.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

SURVEY QUESTIONS

Your Name: Peter Thompson Telephone: (204) 983.5227
Title: Mgr. COMMERCIAL ANALYSIS AND STATISTICS
PROGRAM Co-ordination & Economics BRANCH
Address: DEPARTMENT OF FISHERIES AND OCEANS
CENTRAL AND ARCTIC REGION
501 UNIVERSITY CREB
WPG MB R3T 2N6

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The branch conducts economic analysis and studies, provides planning services and maintains a fisheries information data base in support of DFO regional programs. The primary focus of branch activities is towards regional fisheries planning and management activities.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ☒ 2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

See above

Project objective(s)

See above

Geographic scope (circle one)

global

national

☒ regional

local

If regional or local, what is the geographic area covered?

ONTARIO, MANITOBA, SASKATCHEWAN, ALBERTA,

NORTHWEST TERRITORIES, YUKON (NORTH SLOPE)

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- ☒ 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

*Arctic Cisco Migrations And
Life History*

Project objective(s)

① To determine whether major rearing/overwintering of juvenile Arctic cisco from the Mackenzie River occurs east of the Mackenzie Delta; ② To identify specific areas east of the Mackenzie Delta that may be critical to the maintenance of Mackenzie River Arctic cisco stocks; ③ To quantify the significance of such eastern locations to Mackenzie River populations/stocks.

Geographic scope (circle one)

global
national
☒ regional
local

If regional or local, what is the geographic area covered?

Work currently being conducted in Liverpool Bay complements studies performed previously in the Mackenzie River, along the Takoyaktak Peninsula and Yukon coast, and by researchers in Alaskan coastal waters.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: J.C. Davis

Telephone: 604-356-6515

Title: Regional Director, Science, Pacific Region

Address: Institute of Ocean Sciences, Fisheries and Oceans Canada

P.O. Box 6000, 9860 West Saanich Road, Sidney, B.C. V8L 4B2

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Research programs in hydrography, physical and chemical sciences, and biological sciences, to support conservation of the aquatic resource base and the oceans, and provision of scientific assessment and advice.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?
-

0020

Science
1969/90

Page 1
WORKPLAN NO. 81100230

RESPONSIBILITY CENTRE MANAGER'S DETAILED WORKPLAN FOR WORK ACTIVITY: 1.2.2

RESPONSIBILITY CENTRE NAME: Environmental Contaminants & Aquatic Chemistry

RESPONSIBILITY CENTRE MANAGER: W.J. Cretney (Acting)

ORGANIZATION CODE(S): 1942

REGION: SCIENCE-PACIFIC

RESPONSIBILITY CENTRE DESCRIPTION:

Environmental Contaminants & Aquatic Chemistry conducts research in the chemical sciences on applied problems related to biogeochemical cycling of chemicals, the fisheries and pollution. The applied research includes: (1) the distribution, fate and trends of chemical contaminants in aquatic organisms and water bodies inhabited by marine and freshwater fish, (2) the processes governing the transfer of contaminants among atmosphere/water/sediment/biota, biological effects of contaminants, and predictive models describing their movement and among environmental reservoirs, (3) chemical oceanography and biogeochemistry, with emphasis on the cycling of chemicals, acid rain/LRTAP, coastal water pollution, problems in aquaculture and changes to the coastal baseline, (4) chemical tracers as applied to source identification, contamination of living resources and their habitat, and coastal circulation. Programs of field observations, laboratory experiments and mathematical modelling are undertaken. Clients include the Fisheries Branch (Habitat and Fisheries Management), other government departments such as DOE, DIAND, PERD, foreign governments, universities, the public, industries and the consulting community. Output is provided as direct consultation, scientific publications, input to the regulatory processes through meetings, working groups and cooperative programs.

OBJECTIVE:

To understand the distribution, variability, transportation and fate of chemicals, both man-made and natural, in the marine and aquatic environments and living marine resources, and the exchange of these chemicals with the sediment, atmosphere and land, as well as the inputs from land, rivers, the atmosphere; to contribute knowledge and advice on environmental chemistry to the resolution of regional priorities with the following sub-objectives:

SCIENCE PRIORITY

PROJECT GROUPING TITLE

1. Contaminant Chemistry Laboratory Management
2. Contaminants Chemistry

	PV	OLW	RESOURCES CAP	O/T	G&C	REVENUE
	0.75	35.0				
(PERD)	4.5	90.8	56.8	4.5		
		72.2	10.0			
TOTALS	5.25	125.8	56.8	4.5		
(PERD)		72.2	10.0			

Page 1
WORKPLAN NO. 81100240

SCIENCE
1989/90

1.2.2

RESPONSIBILITY CENTRE MANAGER'S DETAILED WORKPLAN FOR WORK ACTIVITY:

ORGANIZATION CODE(s): 1943

RESPONSIBILITY CENTRE NAME: Ocean Climate Chemistry (CODE)

REGION: SCIENCE-PACIFIC

RESPONSIBILITY CENTRE MANAGER: C.S. Wong

RESPONSIBILITY CENTRE DESCRIPTION:

The program focuses on targeted basic research on ocean chemistry related to climatology, especially on the oceanic modulation of atmospheric greenhouse gases by marine biogeochemical processes and ocean circulation. A monitoring strategy is adopted to quantify large-scale and long-term changes of greenhouse gases (CO₂, CH₄, freons, CO, N₂O, DNS and halocarbons) in the marine atmosphere and ocean waters in the Pacific Ocean and Arctic, by making repetitive measurements of high quality to separate natural from anthropogenic changes over seasonal, interannual and decadal cycles. The work is part of an international effort to predict the partitioning of these gases between the ocean, atmosphere, land and the cryosphere. The major program components are: (1) Primary standards laboratory, (2) Chemical climatic monitoring by ships-of-opportunity and in-house research ships, (3) Ocean biogeochemical modelling to describe the processes and improve the prediction of future levels of these gases in the atmosphere and the ocean. Clients include the national and international research community, such as NOAA and Scripps Institution of Oceanography, and government agencies concerned with climatic changes, such as AES, DOE, and DMR.

OBJECTIVE:

As a CODE (Centre of Disciplinary Expertise), the Centre for Ocean Climatic Chemistry is the designated national centre in DFO for research on greenhouse effects, particularly with respect to the trends of CO₂ relationships between the atmosphere and the oceans, secular changes and oceanic variability of CO₂ and greenhouse gases, and transfer processes between the upper and deep ocean layers for these gases. The Centre also provides a centre of excellence for analytical equipment standardization and methodology, and will be the Canadian focus for the international cooperation essential to the study of this global problem. The present phase has the major objective to understand the oceanic modulation of atmospheric greenhouse gases by marine biogeochemical processes and ocean circulation.

Science
1989/90

0.37

PROJECT GROUPING TITLE: Special Projects - Species Interaction
 DETAILED (WORKPLAN WORK ACTIVITY COMPONENTS): 1.1.1 Resource Assessment and related research
 RESPONSIBILITY CENTRE NAME: Director's Office COLLATOR COSTCODE NO(s): 1910
 PROJECT GROUPING MANAGER: R. J. Beamish

ANY INFORMATION NEEDED/LINKAGE TO PRIORITIES:

Parasitic lamprey have recently been shown to be abundant in B.C. waters. In particular, in the Fraser River, two species of lamprey are extremely abundant and feed upon hake, herring, salmon and other commercially important species in the Strait of Georgia. This study will determine the impact on commercial fishes and whether mortalities caused by lamprey are increasing.

SCIENTIFIC & TECHNICAL PROBLEMS ADDRESSED:

In order to estimate the impact of lamprey predation on commercially important species, we will address the following in 1989/90:

1. Estimate number of feeding adults of L. tridentata leaving and entering the Nicola River.
2. Determine the timing of downstream migration in the Nicola River.
3. Survey of L. tridentata distribution in Fraser R. drainage.
4. Monitor the new Hagfish fishery for "eel skin".

STRATEGY TO PRODUCE NEEDED INFORMATION:

Lamprey leaving and entering the Nicola River will be monitored using traps and electroshocking throughout the spring, summer and fall of 1989.

PROJECT NAME	SCIENCE PRIORITY	PROJECT MILESTONES/RESULTS	RESOURCE SUMMARY			
			PY	QAM	CAP	Revenue
Special Projects - Species Interaction	111.7	Continuation of estimation of marine mortality of lamprey but relocate project to Alberni Inlet. Initiation of a program to monitor new hagfish fishery.				12.0

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WORKPLAN NO. 81100165

Science
1989/90

0, 4, 4

RESPONSIBILITY CENTRE MANAGER'S DETAILED WORKPLAN FOR WORK ACTIVITY: 1.1.1 Resource Assessments and Related Research

RESPONSIBILITY CENTRE NAME: Salmon Production Section	COLLATOR NO(s): 1923
RESPONSIBILITY CENTRE MANAGER: B.E. Riddle	REGION: SCIENCE-PACIFIC

RESPONSIBILITY CENTRE DESCRIPTION:

Reporting to the Director of Biological Sciences. Conducts research and stock assessments on B.C. salmon in support of domestic management needs and Canada's position in international negotiations (IMPFC, PSC, Yukon negotiations). Provides a scientific basis for management decisions, SEP evaluation, and negotiations. Develops information systems, new assessment methodologies and interpretations supporting resource utilization and conservation.

OBJECTIVE:

Develop salmon stock assessment, databases, and new methodologies for management of regional salmon resource, conduct research into biology and productivity of salmon populations and limiting factors to freshwater production of chinook and sockeye salmon, provide management with stock abundance forecasts and formalize a salmon assessment review process for the Region (PSARC); publish scientific papers to communicate results and solicit peer review of our science. This research is carried on in support of Regional Key Priorities I and III.

SCIENCE PRIORITY	PROJECT GROUPING TITLE	PY	RESOURCES		O/T
			OBM	CAP	
1.1	Section Administration (A-base-P.B.S.) (A-base-Vancouver)	1.2	15.0 10.0	16.0 0	0 0
1.1, III.3	Salmon Assessment (A-base) (0.85 PY Term Requests) (1 additional PY casual time requested)	18.7	75.0	19.0	13.5
1.1, III.3	Sockeye Biology (A-base; PY's include 1 Term PY)	3.9	35.0	0	4.0
	(Sub-total (A-base)	23.8	135.0	35.0	17.5
	Salmon Stock Assessment (U.S./CDN Funds)	TO BE REVIEWED			
	Sockeye Biology (U.S./Canada Funds)				
	TOTALS	23.8	135.0	35.0	17.5

* Includes one frozen PY, 0.5 PY casual time for secretarial help in Vancouver, one Term PY for Sockeye Predation studies, and accounts for M. Stocker's PY assuming he is transferred into Salmon Production section.

01/6

Science
1989/90Page 1
WORKPLAN NO. 81100150

RESPONSIBILITY CENTRE MANAGER'S DETAILED WORKPLAN FOR WORK ACTIVITY: I.1.1. Resource Assessment and related research

RESPONSIBILITY CENTRE NAME: Groundfish Section

ORGANIZATION CODE(s): 1918

RESPONSIBILITY CENTRE MANAGER: G.A. McParlane

REGION: SCIENCE-PACIFIC

RESPONSIBILITY CENTRE DESCRIPTION:

Reporting to the Director, Biological Science Branch. Development of the scientific basis for groundfish fishery management advice by means of quantitative stock assessments based on fish sampling from research cruises and from commercial vessel and biological studies to determine biomass, recruitment mechanisms, biological parameters and species interactions.

OBJECTIVE:

To ensure that fishery managers are provided with information and advice that leads to sustainability of fishery catches and that use of the resource is related to its ability to replenish itself in support of FRB priorities. This research supports Regional Key Priorities I and III.

**SCIENCE
PRIORITY****PROJECT GROUPING TITLE**

	PY'S	OLW	RESOURCES		O/T	G&C	REVENUE
			CAP				
I.1	1.5	19.0	35.0		30.0		
I.1, III.3, III.4	16.4	345.0					
I.1, III.7	2.0	50.0					
I.1	0.6	14.0					
TOTALS	20.5	428.0	35.0		30.0		

0113

Science
1985/90Page 1
WORKPLAN NO. 81100130

RESPONSIBILITY CENTRE MANAGER'S DETAILED WORKPLAN FOR WORK ACTIVITY: 1.1.1 Resource Assessment and Related Research

RESPONSIBILITY CENTRE NAME: Shellfish Section

ORGANIZATION CODE(s): 1915

RESPONSIBILITY CENTRE MANAGER: G.S. Jamieson

REGION: SCIENCE-PACIFIC

RESPONSIBILITY CENTRE DESCRIPTION:

Reporting to the Director, Biological Sciences Branch, Conducts research on B.C. commercial invertebrate stocks to provide legal size limit recommendations, gear performance evaluations, allowable catch estimates, biomass assessments, etc.; to determine and describe species life histories and biology; and to identify key environmental and biological factors affecting recruitment and abundance. All to provide scientific advice to management, industry and the public.

OBJECTIVE:

Provision of more relevant, accurate and timely scientific advice to management; to conduct research on the life history and biology of commercial invertebrates with emphasis on factors affecting recruitment, abundance and species interactions; to participate in PSABC and submit advice to managers through this review process; to anticipate future concerns and fishery development opportunities. This research is carried out in support of Regional Priorities I and III.

SCIENCE
PRIORITYIII.3, III.4
I.1

PROJECT GROUPING TITLE	PT'S	OLM	RESOURCES		GAC	REVENUE
			CAP	O/T		
Shellfish Stock Assessment/ PSABC Support/Administration	7.1	71.5	25.0	14.0		
Shellfish Biology	2.3	28.0				
TOTALS	9.4	120.5	25.0	14.0		

0137

Science
1989/90Page 1
WORKPLAN NO. 81100140

RESPONSIBILITY CENTRE MANAGER'S DETAILED WORKPLAN FOR WORK ACTIVITY: 1.1.1. Resource Assessment and Related Research

RESPONSIBILITY CENTRE NAME: HERRING

ORGANIZATION CODE(s): 1917

RESPONSIBILITY CENTRE MANAGER: V. HAIST

REGION: Pacific

RESPONSIBILITY CENTRE DESCRIPTION:

Conduct research on B.C. herring stocks to provide assessments of biomass, stock size, allowable catch, run timing, spawn surveys, recruitment mechanisms and biological parameters, all to provide scientific advice to Fisheries Management, industry and international commissions, and the public.

OBJECTIVE:

To provide more timely and more accurate scientific advice and information for effective management; to conduct research to understand how ocean variability affects species distribution and recruitment; to conduct research to determine whether nearshore developments deleteriously affect herring habitat. This research supports Regional Key Priorities I and III.

SCIENCE
PRIORITY

1.1. III.3, III.4
III.3
III.3

PROJECT GROUPING TITLE

Population Dynamics (PSARC Support)
Recruitment Processes in Inshore Water
Nearshore Herring Environment*

PY'S	O/M	<u>RESOURCES</u>	
		CAP	O/T
6.4	121.8	24.0	4.0
3.4	77.0	1.0	11.7
0.7	15.0		

REVENUE

412

TOTALS

10.5 213.8 25.0 15.7

* PY resources includes 0.2 PYs of Herring Staff in Hecate Strait program

0239

Science
1989/90Page 1
MINIFPLAN NO. 61100190

RESPONSIBILITY CENTRE MANAGER'S DETAILED WORKPLAN FOR WORK ACTIVITY: 1.1.4 Biological Oceanography

RESPONSIBILITY CENTRE NAME: Ocean Ecology Division

ORGANIZATION CODE(s): 1929-1930-1931

RESPONSIBILITY CENTRE MANAGER: K.L. Denman

REGION: SCIENCE-PACIFIC

RESPONSIBILITY CENTRE DESCRIPTION:

Ocean Ecology reports to the Director, Biological Sciences Branch but is located at the Institute of Ocean Sciences. The group consists of 2 program units: one concerned with studies of the benthic (ocean bottom) ecosystem and the other with studies of the planktonic (water column) ecosystem, with resources allocated in roughly a 1/3 to 2/3 split. Research is carried out in the northeast Pacific, continental shelf areas and in coastal embayments and fjords into the identity, distribution, amount and production of planktonic and benthic organisms and communities; and the physical, chemical, and biological factors that influence these properties. Communities are studied both in relation to their importance as the food supply for fish and as an assessment tool for environmental impact measurement and prediction. Clients include OGDs, universities, foreign governments, and the consulting community. Output is provided in the form of direct consultation, scientific publications, input to the regulatory process through the review of industrial proposals, and participation in international conferences and meetings.

OBJECTIVE:

To investigate and understand both natural variations and the consequences of man-induced stress in marine planktonic and benthic ecosystems sufficiently well to enable the provision of advice and prediction of real or anticipated impacts of natural variability (e.g. El Niño or climate change) and of human activity (e.g. fishing activity, habitat destruction or disposal of pollutants). In the plankton program the focus is on understanding the linkages between ocean variability and responses of the lower components of the marine food web on a wide spectrum of time and space scales. In the benthic program the focus is on the description of the benthic community in a natural state, its response to stress, and the use of that response as an indicator of broader ecosystem change as a result of the imposed stress. Supports Regional Key Priority 1.

SCIENCE
PRIORITY1.1
1.1
1.1

PROJECT GROUPING TITLE

Planktonic Ecosystem Processes (Including Central Serv.)
MASS
Benthic Organisms and Communities

PV'S	OLM	RESOURCES		G&C	REVENUE
		CAP	U/T		
2.9	63.0	19.7	12.0		
2.15	68.0	20.3			
1.95	46.5	4.0			
TOTALS	179.5	44.0	12.0		

FORESTRY CANADA

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK
SURVEY QUESTIONS

Your Name: Brian Haddon

Telephone: 813-297-1107

Title: FORSTATS Coordinator

Address: Forestry Canada, Ottawa K1A 1G5 (351 St. Joseph Blvd., 20th Floor, Hull)

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).
-

Not indicator research per se. The objective of the FORSTATS Program is to provide statistical information on Canada's forests and the activities (forest management and forest products industries) of the forest sector. The information is intended primarily for broad policy and public information purposes.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

See attached excerpts from "FORSTATS Program Status Report"

The five program elements of the FORSTATS Program (2) are:

- National Forest Inventory
- Forest Management Statistics
- Forest Resource Dynamics Data
- General Forestry Statistics
- Federal / Provincial Agreements

National Forest Inventory

FORSTATS resource information begins with the national forest inventory. *Canada's Forest Inventory 1981* was a milestone in national forestry statistics. A computer-based system — the *Canadian Forest Resource Data System (CFRDS)* — was used for the first time to summarize data obtained in electronic form from every provincial and federal forest management agency. The national forest inventory was now much more accurate, detailed, and location-specific than had previously been possible. Custom tables, business graphics, and maps could be produced to meet specific information requirements.

Canada's Forest Inventory 1986 is again based on CFRDS. A number of significant improvements were implemented, both in the accuracy and detail of the data and in the ability to produce custom reports. The value of these improvements is reflected in the significant increase in use made of the databases by a wide variety of clients. The report on the 1986 national inventory, and an accompanying report on technical specifications, will be released shortly.

Planning for *Canada's Forest Inventory 1991* has commenced. The next national forest inventory will retain the specifications established for *Canada's Forest Inventory 1986*. It is expected that about 40% of the national forest inventory coverage will be replaced in 1991. Current cost estimates for delivery of "clean" data to the Petawawa National Forestry Institute (PNFI) total about \$750 000. The logistics of acquiring this data have yet to be determined, pending approval of resource commitments by Forestry Canada.

Forest Management Statistics

The FORSTATS operational plan calls for reports at two-year intervals on the following:

- 1) Tree Seed Statistics
- 2) Forest Tree Production Statistics
- 3) Silviculture Statistics
- 4) Forest Management Expenditures

1) **Tree Seed Statistics.** Statistical reports on national forest tree seed collection and use were produced by PNFI in 1984 and 1985. Recently, however, questions have been raised by Forestry Canada and provincial forest management agency staff about the utility of the national forest tree seed surveys. Results and recommendations from an informal review of this report series by the FORSTATS Coordinator suggest that it should be reassessed in terms of the information sought and the utility of the reports to our clients. This issue will be addressed in 1989.

2) **Forest Tree Production Statistics.** The most recent published report in this series was released by Great Lakes Forestry Centre (GLFC) in 1984 with estimates for 1985 to 1988. The next survey is scheduled for the fall, 1989, with a report by late spring, 1990. Data for these reports are obtained

through the cooperation of the regional forestry centres, provincial forest management agencies and the private sector.

3) Silviculture Statistics. The most recent report in this series, *Silviculture statistics for Canada: an 11-year summary*, was released by Northern Forestry Centre in March, 1989. It presents quantitative information on harvesting, site preparation, planting, direct seeding, and stand tending for the period 1975/76 to 1985/86. Data for these reports are obtained with the assistance of the other regional forestry centres. The latest report was accompanied by an attractive public information brochure, *Silviculture in Canada/La sylviculture au Canada*.

Discussions with the Canadian Pulp and Paper Association (CPPA) in 1989 will explore the possibilities of including in future reports information about activities on industrial freehold lands.

4) Forest Management Expenditures. The most recent report in this series, *Forest management expenditures in Canada, 1977-1983*, was published in 1987 as a joint report of the GLFC and the CPPA. Expenditures are reported on silviculture, forest protection, forest access, research and development, and forest management planning and administration, by both government and industry.

Expenditures for the two-year period 1984/85 and 1985/86 were obtained and compiled during 1988. A report for these years will be published by mid-summer, 1989.

CPPA and Forestry Canada, Ontario Region, have agreed to update the report for the period 1986/87 to 1988/89 commencing in the spring, 1990.

Forest Resource Dynamics Data

The national forest inventory offers a partial picture of Canada's forest resources at a given point in time. To present a complete picture of the state of Canada's forests, it is also necessary to understand and quantify the factors that affect those resources. The term, "forest resource dynamics" refers to the factors, natural and otherwise, that serve to directly increase or decrease the extent and value of the nation's forest resources.

Canada's forest area and wood volume balance 1977-1981 was published in 1985. It presented a simple model to describe Canada's forest resource and the changes that occurred during the period 1977-1981. Summary level statistics were presented on the forest capital, accruals, and withdrawals. Discussions are underway between Dr. F.G. Honer, the senior author, and the Forest Science Directorate about updating this FORSTATS report.

Forest Insect and Disease Depletions. Calculation of forest pest depletion estimates is the responsibility of the Forest Insect and Disease Survey (FIDS). The last published national pest depletion statistics appeared in *Forest Insect and Disease Conditions in Canada 1981*, published in 1982. Statistics covering the years 1982 to 1986 will be published in 1989. The possibility of a joint FIDS/FORSTATS public information brochure on national pest depletions will be explored in 1989.

Fire. A report on national forest fire statistics for the four-year period 1984-1987 is in the final stages of preparation for publication at PNFI. A report covering the period 1970 to 1976 is in the final stages of publication. These two reports will bring the published forest fire statistics completely up to date to the end of the 1987 fire season. These reports present statistical information by province on fire distribution by cause, size, and month, along with areas burned and values lost.

through the cooperation of the regional forestry centres, provincial forest management agencies and the private sector.

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Forest Productivity. PNFI has developed a forest productivity database as an auxiliary database to *Canada's Forest Inventory 1986*. It comprises previously published mean annual increment data, along with improvements, as available, from the provincial forest management agencies. The data are used in conjunction with other inventory data to compute estimates of accruals on a national or broad regional basis.

Federal Lands. In 1988, the Forestry Development Directorate, Forestry Canada, HQ, published *Timber Harvest on Federal Lands 1986-1987* and two brochures, *Federal Forests in Canada 1987* and *Les forêts fédérales du Canada 1987*, both bearing the FORSTATS logo. *Timber Harvest on Federal Lands 1987-1988*, to be published in late spring, 1989, will include summary data on areas treated and expenditures for silviculture activities on federal lands.

General Forestry Statistics

The FORSTATS operational plan calls for annual publication of the following:

- 1) a report of selected forestry statistics of general interest to Canada's forest community;
- 2) statistical data relating to Canada's trade in forest products;
- 3) statistical data on labour and employment in the forest sector;
- 4) continued production of the leaflet *Canada's Forests*.

1) **Selected Forestry Statistics.** *Selected Forestry Statistics Canada* is published annually by the Economics Branch, Forestry Canada, HQ. Forestry Canada, Ontario Region, publishes *Selected Forestry Statistics, Ontario*. These complementary reports are identified as FORSTATS reports by the logo on their covers. The most recent reports were published in 1988 and 1987, respectively.

2) **Forest Products Trade.** There is not, to date, a report series on Canada's trade in forest products. FORSTATS will explore opportunities for producing a public information brochure with the Industry, Trade, and Technology Directorate and the Economics Branch during 1989.

3) **Labour and Employment.** Forest renewal and tending activities in Canada have increased significantly over the past 10-year period. Human resource requirements to match this rapid rise in activity have not been addressed in any detail. A pilot project conducted by the Forestry Development Directorate is underway in eastern Ontario to obtain socio-economic information on the silvicultural worker. A report will be available by the end of fiscal 1989/90.

Canada's forest sector employs one worker in 15. To depict the relative importance of this labour force, FORSTATS will explore with the Forestry Development Directorate opportunities for producing a public information brochure on this subject.

4) **Canada's Forests.** *Canada's Forests* is a popular public information brochure produced annually by the Economics Branch. It is identified as a FORSTATS product by the logo on the front.

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Joe J. Lowe Telephone: (613) 589-2880
Title: Manager, Forest Inventory Project
Address: Petawawa National Forestry Institute, Forestry Canada
Box 2000, Chalk River, Ontario K0J 1J0

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Provide information on the forest resource of Canada for departmental and public use. This is in support of Forestry Canada's FORSTATS programme, and by arrangement with Stats Can. Uses are too varied to describe, but vary from support of strategic forestry decisions to general public and educational information.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
- X 4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Forest Inventory Project

Project objective(s)

For those pertaining to this questionnaire -
see attached

Geographic scope (circle one)

global
national
regional X
local

If regional or local, what is the geographic area covered?

- Objective III. National Inventory: To develop, use, and maintain Canada's Forest Inventory and related information.
- III.1 Maintain, renew, and report Canada's Forest Inventory on a 5 yr. cycle.
 - III.2 Develop, maintain, renew, and report such other forest resource data within CFRDS as required.
 - III.3 Make full use of CFRDS data for:
 - information requests
 - information reports
 - cooperative studies
 - III.4 Ensure the availability of adequate and efficient CFRDS facilities for:
 - Project needs
 - other FORSTATS needs as approved
 - technology or data transfer
 - III.5 Use the national inventory in support of acid precipitation and climate change studies to illustrate the resource at risk and to support impact studies.

(Note: Related information includes the national biomass inventory)

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: B. H. MOODY

Telephone: 997-1107

Title: FIDS Coordinator, Science Directorate, Forestry Canada

Address: Place Vincent Massey
351 St. Joseph Blvd, 21st fl.
Hull, Quebec, K1A 1G5

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The Forest Insect and Disease Survey program provides national coordination of regional FIDS unit's activities which are managed by the 6 regional ~~est~~ establishments. Regional FIDS units operate in a coordinated manner to obtain data on the state of insect and disease conditions regionally. Reports prepared from regional information and expertise provide the state of insect and disease conditions in Canada and in proximity to Canada, and relate these to national interests and federal responsibilities.

This program also coordinates the National Early Warning System for "Acid Rain" damage to Canada's forests. On an on-going basis, regional FIDS units survey and monitor for any changes to forest trees due to air pollutants including acid disposition.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

FIDS Heads at 6 regional establishments:

Dr. G. M. Howse, Great Lakes Forestry Centre

Dr. D. Lachance, Laurentian Forestry Centre

Dr. L. P. Magasi, Forestry Canada - Maritimes

Dr. J. Hudak, Newfoundland Forestry Centre

Dr. H. F. Cerejke, Northern Forestry Centre

Dr. G. A. Van Sickle, Pacific Forestry Centre

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
- ② rates of harvest, ^{depletion by insects, diseases and fire} and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Forest Insect and Disease Survey Coordination

Project objective(s)

Coordination, evaluation and assessment of the national programs in Forest Insect and disease Survey including activities under the Plant Quarantine Act, Forest Pest surveys, Pest Depletion (Damage) Estimates, Historical Insect and Disease Data Management Systems (FIDS INFOBASE), Collection of baseline data on the forest environment, etc.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

HEALTH AND WELFARE CANADA



Health and Welfare Canada Santé et Bien-être social Canada

Health Protection Branch Direction générale de la protection de la santé

Tunney's Pasture
Ottawa, Ontario
K1A 0L2

October 17, 1989

Mr. Gregg Sheehy, B.E.S., M.Sc.F
Environmental Consultant
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

This is in reply to your letter of September 28, 1989 concerning environmental indicators.

I am pleased to enclose completed questionnaires which reflect ongoing activities in the Food Directorate of the Health Protection Branch of Health and Welfare Canada. These relate to items 7, 8 and 9 in your letter, namely human exposure to toxic chemicals, contaminant levels in food and exposure of fish to toxic chemicals.

I trust that this information will be of assistance to you in your efforts to help establish a research network. I would, in turn appreciate receiving a copy of the final report.

Yours truly,

S.W. Gunner, Ph.D.

cc: D. Kirkpatrick
Director - Bureau of Chemical Safety
Health Protection Branch

Canada

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. H.B.S. Conacher

Telephone: 057-0944

Title: Chief, Food Research Division

Address: 3rd Floor East, Sir Frederick Banting Building, Health Protection
Branch, Tunney's Pasture, OTTAWA, K1A 0L2

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The general purpose of our indicator research is to determine the levels of potentially hazardous chemicals in foods. These data, when combined with appropriate food intake data, are used to assess the exposure of Canadians to these chemicals. Should this exposure be considered too high in terms of public health appropriate control action is taken to reduce the exposure. Thus this type of program contributes towards ensuring a safe food supply.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

Suggest: Environmental Health Directorate, Field Operations Directorate,
LCDC within HPB.

Suggest: Fisheries and Oceans, Agric. Canada, Environment Canada within
Government.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project Assessment of Effluents from Canadian Pulp/Paper Mills
(joint with Fisheries & Oceans and Environment Canada)

Project objective(s) To determine the levels of organochlorine
contaminants (specifically at present chlorinated dibenzodioxins and -
furans) in fish and other marine species in locations near pulp mills;
to assess significance to human health of these chemicals; and to take
control action as appropriate.

Geographic scope (circle one) global
 national
 regional
 local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Project #94

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project General Monitoring of Selected Foods

Project objective(s) To assess levels of potentially hazardous chemicals in selected foods; to assess significance to human health of their presence; and to take control action as appropriate.
(Ongoing project involving variety of potential hazardous chemicals).

Geographic scope (circle one) global
 ☒ national
 regional
 local

If regional or local, what is the geographic area covered?

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project National Human Breast Milk Survey

Project objective(s) To assess levels of potentially hazardous chemicals in human breast milk collected from across Canada; to assess any geographical differences; to assess temporal trends in these levels; to assess significance to human infant health of their presence; and to take control action as appropriate.

Conducted every 5 years. Current survey involves ~400 samples.

Geographic scope (circle one) global
 ☒ national
 regional
 local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Total Diet Survey

Project objective(s)

To assess levels of potentially hazardous chemicals in foods (prepared for consumption) collected across Canada: to assess any geographical differences; to assess significance to human health of their presence; and to take control action as appropriate.
 Conducted approx. every 5 years with market baskets (~500 foods/basket) from 5 major urban centres.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. F. Iverson

Telephone: 957-0987

Title: A/Chief, Toxicology Research Division

Address: 2nd East

Sir Frederick G. Banting Research Centre
Tunney's Pasture

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

The research program is directed to acquire toxicological data from in vitro and in vivo studies that can be used to assess the human health hazard of substances (chemical contaminants, additives, pesticides) that may enter, or be formed naturally, as part of the Canadian food supply. This may include substances that are of "environmental" concern. The toxicology data is, where applicable, used to set allowable limits for the occurrence of these substances in food. The research projects include, but are not limited to, acute and chronic studies on experimental animals to determine the carcinogenic, immunotoxic, neurotoxic and teratogenic potential of chemicals as well as the means by which the substances produce their toxic effects. The latter function is essential in the rational extrapolation of toxic effects from animal models to humans.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Systemic toxicity of Shellfish toxins.

Project objective(s)

To determine the target organ toxicity of domoic acid, a neurotoxin found in cultivated mussels. This project is designed to provide the basic toxicology data base for the mussel toxin that produced acute toxicity in many individuals in late 1987.

Geographic scope (circle one)

☒ global

national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Project #97

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Chronic toxicity of vomitoxin (deoxynivalenol),
a mycotoxin found in cereal grains.

Project objective(s) To determine the toxic effects (including neoplasia,
immune suppression, cell proliferation) in mice fed vomitoxin over a 2 year
period. This tricothecene mycotoxin has been subjected to acute toxicity
testing. This project will determine the chronic toxicity associated with
consumption of low levels of the fungal metabolite.

Geographic scope (circle one) ☒ global
national
regional
local

If regional or local, what is the geographic area covered?

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Teratogenic potential of chemicals

Project objective(s)

To assess the potential of chemicals to produce teratogenic and or maternal toxicity effects in experimental animals. This project also is concerned with the application of in vitro methods of teratogenicity testing and in the effect of maternal toxicity on the mechanism of teratogenicity.

Geographic scope (circle one)

☒ global

☐ national

☐ regional

☐ local

If regional or local, what is the geographic area covered?

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
- ☒ 7. human exposure to toxic chemicals.
- ☒ 8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project Toxicity of Polychlorinated Biphenyls to primates
(rhesus monkeys).

Project objective(s) To determine the levels of PCB having an effect on primate reproduction and to determine the level of PCB without effect on infants born to mothers with elevated body burdens of PCB. The acute toxic effects of PCB appear to occur only at relatively high levels in rodents. This study is assessing the long term toxicity of PCB at low levels in an animal model that appears to be extremely sensitive to PCB.

Geographic scope (circle one) ☒ global
national
regional
local

If regional or local, what is the geographic area covered?



Health and Welfare
Canada

Santé et Bien-être social
Canada

Health Protection
Branch

Direction générale de la
protection de la santé

Room 134

Environmental Health Centre
Tunney's Pasture
Ottawa, Ontario
K1A 0L2

October 6, 1989

Mr. Greg Sheehy
Environmental Consultant
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

Thank you for your letter of September 28, 1989 concerning your survey on environmental indicators research in the federal government. I understand you have written separately to the Food Directorate and, therefore, I am limiting my response to the relevant program areas within the Environmental Health Directorate. These fall within your categories 6 and 7, namely; levels of contaminants in air, water or land and human exposure to toxic chemicals.

As we agreed in our telephone discussion I am sending you project area documentation from our annual project review. These contain all the information required for your survey questionnaire. I have included the following project areas:

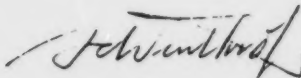
- 01 Environmental Radioactivity and Human Monitoring
- 22 Drinking Water
- 27 Pesticides
- 28 Long-Range Transport of Air Pollutants
- 29 Indoor Air Quality and Energy
- 31 Environmental Pollutants
- 32 Industrial and Commercial Chemicals

.../2

- 2 -

I am also including a copy of report no. 87-EHD-4, which describes the activities of the Directorate in a more general way and will help to put the project area descriptions in some context. I trust this information will satisfy your need.

Sincerely,



S.O. Winthrop
Senior Adviser
Environmental Health Directorate

Attach.

c.c. Mr. J.R. Hickman

PROJECT AREA 22

ANNUAL REVIEW, 1989

DRINKING WATER

This project reflects the Directorate's responsibility of programmes related to the health aspects of drinking water including the revision of the Guidelines for Canadian Drinking Water Quality. Current activities include:

- (i) review of legislation;
- (ii) review and updating of the Guidelines;
- (iii) identification of health hazards posed by point-of-use treatment devices;
- (iv) research to determine the nature and quantities of trace contaminants in drinking water;
- (v) monitoring, toxicological and epidemiological surveys relating to Canadian drinking water quality; and
- (vi) investigation of ways to remove toxic materials from drinking water.

Consultation, co-ordination of programmes and exchange of information with provincial and other federal departments is maintained through the Federal-Provincial Subcommittee on Drinking Water. The Directorate also provides scientific expertise on health aspects of water-related contaminants to the IJC and to international agencies, including PAHO and WHO.

Project
Co-ordinator: Ms. M.E. Meek

Prepared: January 1989
Reviewed: February 1989

A. OBJECTIVES (Long Term)

1. To estimate and assess the adverse impact on health that can result from exposure to drinking water contaminants.
2. To prevent or control the risks to health from contaminants in drinking water by developing and promoting timely and effective management strategies.
3. To ensure that accurate information on the health risks posed by contaminants of drinking water, and on ways to reduce or eliminate the risks, is available to regulatory authorities and the public.

Primary Impact:

- availability of safe drinking water in all areas of Canada.

Secondary Impact:

- existence of national guidelines for drinking water quality to provide the basis for provincial and municipal standards; improved drinking water quality in Canada and abroad; technology transfer to Canadian industry. Potential increased costs for the Canadian consumer living in areas of existing inadequate water quality.

ENVIRONMENTAL RADIOACTIVITY (ANNUAL REVIEW, 1989)

The primary objective of the Project is to assess and manage the risks to the Canadian population from radioactivity in the environment and from internal exposures in the work place. To achieve this objective, ongoing programs are carried out to provide baseline data against which to assess accidents and unusual events, to provide a National Reference Centre and quality assurance programs for internal exposure measurements. Research projects are conducted to investigate uptake, metabolism and biological effects of radioactivity in humans. Investigations are supported through development of new radiochemical procedures, evaluating and integration of new radiation detection instrumentation. Emergency planning for nuclear accidents is occupying an increasing amount of time.

Highlights of 1988-89

Extensive Planning for the 3% chance that the Soviet nuclear powered satellite Cosmos 1900 might reenter over Canada.

Acceptance of and implementation of whole body measurements of cesium-137 in two northern communities, Baker Lake and Rae-Edzo.

Response to three unusual incidents involving the unplanned release of radioactivity - from static eliminators, a gamma radiation facility and the Chalk River Nuclear Laboratories.

Successful implementation of the uranium-in-air study in Port Hope.

Project
Coordinator: D.P. Meyerhof

Prepared: January, 1989
Reviewed:

A. OBJECTIVES (LONG TERM)

The overall objectives of the project are to assess and manage the risks to the Canadian population from radioactivity in the environment and from internal exposures in the workplace, by recommending actions to ensure that these exposures are kept as low as reasonably achievable, and by interacting with the public, industry, governments and international agencies.

Reduced risks to the population are achieved by:

1. Ensuring that workers don't suffer over exposures from internal radioactivity through assurance that methods for assessment of internal exposures are accurate. This is done through provision of a National Reference Centre and Quality Assurance Program.
2. Providing baseline data and long term trends for estimations of health risks from environmental radioactivity, and reference points for emergencies and unusual incidents through the operation of a national monitoring network.
3. Assuring the management of risks to the public from operating nuclear reactors by conducting local monitoring.
4. Managing the federal government's response to nuclear emergencies under the Federal Nuclear Emergency Response Plan and responding effectively to other crises.
5. Investigating the uptake, metabolism and biological effects on humans of radioactivity in the environment and workplace.
6. Developing criteria and guidelines for radioactivity in the environment and workplace.
7. Maintaining a high degree of scientific expertise to achieve the credibility required to be the focal point for national and international cooperation.

PROJECT AREA 29

ANNUAL REVIEW, 1989

INDOOR AIR QUALITY AND ENERGY

This project reflects the Directorate's responsibilities related to the health aspects of indoor air quality (IAQ) and federal energy programs. The principal objectives are: to assess the hazards to human health associated with indoor air contaminants and those resulting from energy-related initiatives and developments; and to make recommendations to minimize potential health hazards.

Current activities include investigations to determine the toxicity and potential human exposure to materials such as polycyclic aromatic hydrocarbons (PAH), substituted furans, aldehydes, chlorinated and simple aromatics, aromatic amines, indoor particulate matter, and gasoline octane boosters. Exposure to these materials may arise from their occurrence in indoor air due to human activities and the use of certain materials in buildings or through their presence during the development, production and use of new fuels or unconventional sources of energy, such as those derived from oil sands and coal. "Exposure Guidelines for Residential Indoor Air Quality" have been published and a protocol for the investigation of indoor air quality problems in offices and institutional buildings will be prepared.

Project
Co-ordinator: Mr. R. Otson

Prepared: January 1989
Reviewed: February 1989

A. OBJECTIVES (Long Term)

1. To estimate and assess the adverse impacts on health from exposure to contaminants of indoor air.
2. To estimate and assess the adverse impacts on health which result from new energy related initiatives and developments.
3. To prevent or control the risks to health from indoor air contaminants and from new energy related developments by developing and promoting timely effective management strategies.
4. To ensure that information on the health risks posed by indoor air pollutants is available to regulatory authorities and the public.

Impacts:

- Reduction or elimination of hazards from agents introduced or accentuated by energy-related programs, both in the home and office environment, and in the industrial environment, with a consequent reduction in productivity losses, discomfort, and illnesses due to these agents.
- Ability to predict processes and materials which have the potential for production of undesirable agents associated with human health hazards, and to act before large sums of money are spent, rather than to react after such processes have already been put into operation.
- A public better informed about the nature and severity of potential health hazards resulting from energy-related initiatives and developments.

A.-1

PROJECT AREA 28

ANNUAL REVIEW, 1989

LONG-RANGE TRANSPORT OF AIR POLLUTANTS

Activities in this project area involve research into the direct health effects of airborne acid forming pollutants and the indirect effects on the quality of water which may result from the deposition of acidic pollutants. The work is designed to complement studies being undertaken by other federal and provincial agencies into environmental and other consequences of LRTAP and could contribute to Canadian efforts to secure an air quality agreement with the United States. Research activities have been designed to investigate the potential direct and indirect health effects and to define more precisely the levels of airborne contaminants such as sulphur dioxide, nitrogen dioxide particulate matter, and acid aerosols to which segments of the population are exposed and to assess the effects of these substances on susceptible individuals. Preliminary epidemiological investigations have been completed and additional research projects based on the results of these studies are in progress. Surveys assessing the effects produced by acidic deposition on drinking water are currently underway. More comprehensive studies evaluating health responses to these pollutants are an integral component of the proposed program. It was also concluded that recreational activities in water affected by acidic deposition represent no significant threat to human health. Efforts are also being directed at developing more accurate estimates of personal exposure by examining information on activity patterns and relationship between indoor concentrations of specific pollutants.

Project
Co-ordinator: M. Raizenne

Prepared: January 1989
Reviewed: February 1989

A. OBJECTIVES (Long Term)

1. To estimate and assess the adverse impacts on health from exposure to airborne pollutants that are subjected to long range transport, and to monitor the influence of abatement programs on health.
2. To assess the extent to which human exposure to potentially toxic substances, such as trace elements, is affected by the deposition of acidic substances and other contaminants borne by long-range atmospheric transport, and to monitor the influence of abatement programmes.

Impacts Statement:

Impacts of the following nature can be anticipated, assuming that scientific data demonstrate the existence of health-related problems. A reduction in the frequency and severity of adverse health effects which result from exposure to contaminants introduced by long-range atmospheric transport is anticipated. Amelioration of problems caused by airborne pollutants will necessitate the development of new energy production and emission control technologies, the cost of which would eventually be borne by the general public in Canada and the United States; a concomitant reduction in health-care and other related costs would be expected.

PROJECT AREA 32

ANNUAL REVIEW, 1989

INDUSTRIAL AND COMMERCIAL CHEMICALS

This project reflects the Directorate's responsibilities under the Canadian Environmental Protection Act related to the health aspects of chemicals new to commerce in Canada and biotechnology products, and under the Hazardous Materials Information Review Act for chemicals used in the workplace.

The Canadian Environmental Protection Act (CEPA) was proclaimed in June 1988. The Act incorporates regulations already developed under the Environmental Contaminants Act, the Clean Air Act, the Canada Water Act, Part III and the Ocean Dumping Control Act. Under CEPA, all aspects of the lifecycle of toxic substances may be controlled, from development to manufacture or importation, transportation, distribution, storage, use, and their ultimate disposal.

With respect to substances new to Canada, the Act requires that a manufacturer or importer provide the government with information prescribed in the New Substances Notification Regulations prior to manufacture or importation. The prescribed information varies depending on the quantity to be manufactured or imported and whether or not it is included in the Non-domestic Substances List.

It is anticipated that the majority of submissions for chemical substances will include the "intermediate" information requirements. This information includes identity, physical and chemical properties, one acute mammalian toxicity test, intended uses, recommended methods for destruction or disposal, and anticipated emissions and discharge. The "full" information requirements also include an additional acute mammalian toxicity test, skin tests, mutagenicity test data, aquatic toxicity tests, and one 14-day toxicity test.

Information requirements for biotechnology products include identification, the presence of biological activity, survival, growth, reproduction, physiological characteristics, use, dispersal in the environment, toxicity and pathogenicity to animals and plants, human toxicity and pathogenicity test data and exposure estimation, proposed field trials, and information on the proposed site(s) of environmental application.

Two of the major tasks within the project are to conduct preliminary assessments of potential health risks of new chemicals and of biotechnology products, within specified timeframes, based

PROJECT AREA 32

ANNUAL REVIEW, 1989

upon the dossier of information described above that must be submitted prior to manufacture or importation. In order to carry out such an assessment, it is necessary to determine potential levels of a substance in the environment, to what extent it can be absorbed by the body and its intrinsic toxicity to humans. Control measures will be developed where required.

The main focus of the work at first will be finalizing notification regulations, the development of test procedures for biotechnology products and the development of evaluation procedures for carrying out assessments.

Research oriented goals include the development of procedures to provide data necessary for conducting assessments on new biotechnology products and improvements to existing test protocols for physical and chemical properties of new chemicals. In addition, innovative ways in which to estimate potential exposure to new substances will be developed.

The Workplace Hazardous Materials Information System (WHMIS) and the Hazardous Materials Information Review Act (HMIRA) were passed in June 1987 and implementation of the legislation began in October 1988. Under WHMIS, suppliers of and employers using hazardous materials are required to disclose certain information on the label and to provide a material safety data sheet for each product. The Department of National Health and Welfare is responsible for reviewing the material safety data sheets and labels of products for which exemptions have been claimed from the reporting requirements of WHMIS on the basis that the information is confidential.

The third major task of the project involves evaluating the adequacy of Hazardous Materials Information Sheets received from the Hazardous Materials Information Review Commission established under HMIRA.

Project
Co-ordinator: J. Sitwell

Prepared: January 1989
Reviewed: February 1989

A. OBJECTIVES (Long Term)

1. To estimate and assess the adverse impact on health that can result from exposure to industrial and commercial chemicals and biotechnology products.
2. To prevent or control the risk to health from industrial and commercial chemicals and biotechnology products by developing and implementing timely and effective management strategies.
Primary Impact: Risk Management - reduction or prevention of health risks posed by exposure to chemical and biological agents in the environment.
Secondary Impact: Economic - constraints on industry with respect to controls on industrial processes, trade in, and use of, toxic substances, and waste disposal; - international harmonization in the assessment of potentially hazardous substances.
3. To ensure that information is provided to inform, persuade or warn others about the risks to health associated with industrial and commercial chemicals and the products of biotechnology.
Primary Impact: Workers and the general public more knowledgeable about risks to health from the manufacture and use of chemicals and better informed about procedures to protect health from chemical and biological substances.

PROJECT AREA 31

ANNUAL REVIEW, 1989

ENVIRONMENTAL POLLUTANTS

This project reflects the Directorate's program on chemicals that are demonstrated or suspect environmental contaminants and have the potential to adversely effect human health. The project encompasses work associated with the Priority Substances List established under the Canadian Environmental Protection Act (CEPA) as well as work under the Great Lakes Water Quality Program, including supportive toxicology and monitoring studies. Also included in this project is the development of recreational water quality, multimedia, and ambient air quality guidelines.

The Canadian Environmental Protection Act (CEPA) was proclaimed in June 1988 and incorporates regulations previously developed under the Environmental Contaminants Act, the Clean Air Act, the Canada Water Act Part III, and the Ocean Dumping Control Act. Under CEPA, all aspects of the lifecycle of toxic substances may be controlled, from development to manufacture or importation, transportation, distribution, storage, use, and disposal. Under Part I of the act the Minister of National Health and Welfare is required to assess the health risks posed by chemicals and to formulate health based guidelines and codes of practice. Environmental quality guidelines will recommend levels of a substance in air, water and soil will serve as reference points against which to judge the adequacy of the controls implemented under CEPA. Under Part II of CEPA the Minister of National Health and Welfare and the Minister of the Environment are jointly responsible for compiling a "Priority Substances List" which will specify substances which priority should be in assessing whether those substances are toxic or are capable of becoming toxic. A mechanism has been implemented to identify certain chemicals among the myriad found in the environment for assessment and possible regulation.

Revisions to the Great Lakes Water Quality Agreement incorporate a number of initiatives to deal with the public's concern that pollution in the Great Lakes is affecting their health. The initiatives pertinent to this Project include formulating guidelines (Water Quality Objectives) that are based on human health as well as environmental considerations, participation in Remedial Action Programs, and research on the toxicological effects of identified pollutants.

Toxicology and mutagenicity research is being carried out on chemicals in the environment deemed to be of high priority and for which insufficient data exist to conduct a risk assessment. Efforts are continuing to develop, adapt or modify techniques to measure more sensitive endpoints of toxic response. Considerable effort is also being made to search out methods that provide alternatives to the use of animals for testing and to reduce the numbers of animals used where alternatives are not feasible.

Project
Co-ordinator: D.C. Villeneuve

Prepared: January 1989
Reviewed: February 1989

A. OBJECTIVES (Long Term)

1. To estimate and assess the risks to health associated with exposure to chemicals in the environment.
2. To prevent or control the risks to health from chemicals in the environment by developing and implementing timely and effective management strategies.
Primary Impact: Reduction of health risks from exposure to chemicals in the environment.
Secondary Impact: Economic - constraints on industry with respect to controls on industrial processes, trade in, and use of, toxic substances, and waste disposal; - international harmonization in the assessment of potentially hazardous substances.
3. To ensure that information on the health risks associated with the presence of chemicals in the environment is available to the public.
Primary Impact: A public knowledgeable about the health risks from exposure to chemicals in the environment.

A.-1

PROJECT AREA 27

ANNUAL REVIEW, 1989

PESTICIDES

The major objectives of this project are (1) to reduce the health risks to pesticide applicators, formulators, agricultural workers, other users and bystanders, from the use of new and existing pesticide products and (2) to ensure that information on the risk from pesticide use as well as the methods for reducing this risk are available. Advice is provided to Agriculture Canada, provincial and local regulatory authorities, the chemical industry and the public, based on reviews of existing information and to a lesser extent on experimental investigations.

Only pesticides registered under the Pest Control Products Act (administered by Agriculture Canada) may be sold in Canada. A major task within the Project is to undertake safety evaluations of new pesticides based upon the dossier of toxicologic and exposure information required in support of a registration petition. The Department provides health advice to the Department of Agriculture based on these assessments.

Many pesticides were originally registered before the requirements for registration were as stringent as today. A process of re-assessment of the safety of these older products has therefore been initiated in collaboration with Agriculture Canada, Environment Canada and Fisheries and Oceans Canada.

Field and laboratory studies are carried out to investigate the extent of exposure to pesticides and the effectiveness of protective clothing. Exposure studies can measure deposition, absorption and urinary excretion of pesticides and their metabolites. Investigations are undertaken on those exposed as a result of their employment, and on bystanders. The knowledge gained is used to develop exposure models to take into account various chemical groups and use settings.

Project
Co-ordinator: F. Wandelmaier

Prepared: January 1989
Reviewed: February 1989

A. OBJECTIVES (Long Term)

1. To estimate and assess the adverse impact on health that can result from exposure to pesticides during formulation and application.
2. To prevent or control the risks to health from pesticides by developing and promoting timely effective management strategies.
3. To ensure that information on the hazards of pesticides and on ways to reduce the risks related to pesticide use is available to provincial regulatory authorities, the medical profession, applicators and the public.

Direct Impact

- On regulatory decisions made by Agriculture Canada.
- Direct effect on pesticide industry regulated under the PCP Act; direct effect on availability of pesticides to user groups, agriculture, forestry.
- On information levels available on medical profession, applicators and public regarding informed safe use of pesticides.

Economic Effects on Producer and User Industries

These objectives directly affect the chemical industry which is regulated through these initiatives under the PCP Act. There are also major effects on the agricultural and forestry industries which utilize registered pesticides.

NATIONAL ENERGY BOARD

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: *David Collier* Telephone: *998-7752*
Title: *Director, Energy Supply Branch*
Address: *National Energy Board*
+73 Albert Street
Ottawa, Ontario

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

National Energy Board Energy Supply Branch keeps under review
prices of crude oil, natural gas, and their by-products
in Canada. The purpose of this work is to provide a
basis for regulation of energy trade (imports, pipeline
prices and tolls) and to assist in an advisory capacity by
making such information available to the public.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

National Energy Board - Electric Power Branch - A. Karas (Director)
Department of Energy, Mines and Resources

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
- ③ 3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Canadian Energy Supply and Demand report

Project objective(s)

On a biennial basis to provide in the public domain a comprehensive analysis of the remaining supplies and expected rate of depletion of natural gas and crude oil. Analysis includes, estimation of reserves, resource potential, production rates, supply costs, etc. as well as a review of recent trends in these factors.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

NATIONAL MUSEUM OF NATURAL SCIENCES



National Museums of Canada Musées nationaux du Canada
National Museum of Natural Sciences Musée national des sciences naturelles
Ottawa, Canada
K1A 0M8
P.O. box 3443, Station "D"
Ottawa, Ontario K1P 6P4

17 October 1989

Mr. Gregg Sheehy
7011 Bilberry Drive
Orleans, Ontario
K1C 2C2

Dear Mr. Sheehy:

The National Museum of Natural Sciences is pleased to cooperate with you and Environment Canada in the State of the Environment Reporting Program. As you know, the Museum, with its collections and active programme of research, has for many years been a major source and generator of knowledge in the natural sciences. We have also actively collaborated with our colleagues in many federal and provincial agencies in projects directed toward greater understanding of Canada's natural resources.

I have attached a number of specific responses to your Federal Environmental Indicator Research Network survey questions, and have also included for the purposes of the proposed network a list of our researchers and their areas of research interest and specialty. I would stress that the Museum, through its research and its exhibits and other public programmes, is not only interested but is also capable of making a major contribution toward awareness of and solutions to the environmental problems which plague our global community. Please contact me if we can be of help.

Sincerely,

Dr. Stephen L. Cumbaa
A/Assistant Director
Collections and Research
tele: (613) 996-9282
FAX: (613) 952-9693

cc: Dr. Leslie Whitby

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: *Darlene Balkwill*

Telephone: *990-6410*

Title: *Acting Head, Zooarchaeological Identification Centre, N.M.N.S.*

Address: *491 Bank St., Ottawa*

mailing address: P.O. Box 3443, Station D, Ottawa, K1P 6P4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Identification of fish remains (bones, scales, and especially otoliths) and the detection of abnormal bone formation. This is provided as a service to various wildlife agencies. These data are used to monitor changes in fish populations and species composition of lakes and rivers subject to environmental pollution.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ⑨. exposure of fish and wildlife to toxic chemicals.

Name of Project

Duck Stomach Contents

(in collaboration with Ont. Ministry of Natural Resources)

Project objective(s)

① Identification of fish remains (bones, otoliths, & scales) from the stomachs of ducks from various localities

② Detection of abnormal bone formation

③ Comparison of fish species found in lakes with varying degrees of acidification

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Sudbury - Algoma region of Northern Ontario - however, could be used on a national scale.

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Caspian Tern Pellets Analysis
in collaboration with Canadian Wildlife Service

Project objective(s)

- ① identification of fish remains from Caspian tern pellets
- ② comparison of number and quantity of fish species found now with that found in 1978 and 1979
- ③ changing composition of fish population related to changing pollution levels

Geographic scope (circle one)

global
national
regional
local

If regional or local, what is the geographic area covered?

Great Lakes area

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: D.A. Bondy

Telephone: 954-7676

Title: Acting Chief, Zoology Division

Address: National Museum of Natural Sciences

P.O. Box 3443, Station D

Ottawa, Ontario

K1P 6P4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Research is conducted in order to increase our knowledge about animals and to provide a basis for the activities of the Museum and of zoological research in Canada.

Indicator data is used in resources and biodiversity inventories, environmental impact assessments, development of conservation and management plans, specimens are used to monitor toxics over time and space, biogeography studies reflect changes in species distribution, and biodiversity data are included in DOE's Status of the Environment Report.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Taxonomy and Ecology of Polychaete Worms

Project objective(s)

Study the extraordinarily rich fauna to be found in and around pulp mills.

Geographic scope (circle one)

global
national
☒ regional
local

If regional or local, what is the geographic area covered?

British Columbia

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ⑥ levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
- ⑨ exposure of fish and wildlife to toxic chemicals.

Name of Project

Impacts of Acidification on Littoral Microcrustacea

Project objective(s)

Examine how communities change along a pH gradient and try to correlate community structure with pH. Microcrustacea are sensitive to even slight changes in environmental loadings.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

Shield lakes in Ontario

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: Dr. Michel Poulin

Telephone: 990-6454

Title: Chief, Botany Division

Curator, Phycology Section

Address: Botany Division, National Museum of Natural Sciences

P.O. Box 3443, Station D

Ottawa, Ontario K1P 6P4

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Répartition des éléments floristiques (plantes vasculaires et
cryptogamiques) et évaluation de leur incidence à devenir des éléments
indicateurs de perturbations environnementales. Conforme à l'énoncé
de la division de la botanique.
Ces données sur les espèces indicatrices peuvent servir à déterminer
le degré de pollution atteint par certains habitats et ainsi conduire
à minimiser les effets des polluants.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Plantes vasculaires rares du Canada

Project objective(s)

Répartition des plantes rares au Canada visant à la détermination de régions écologiquement fragiles et à la planification de la protection de la nature. Evolution du status des espèces de plantes rares.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
- ☒ 6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Lichens du Canada

Project objective(s)

Répartition et évolution des lichens du secteur canadien lesquels maintiennent une certaine intolérance face à la pollution atmosphérique.

Geographic scope (circle one)

global

☒ national

regional

local

If regional or local, what is the geographic area covered?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

Diatomées marines et dulcicoles du Canada

Project objective(s)

Répartition des diatomées en milieu aquatique. Identification d'éléments floristiques (espèces) indicateurs de différents types de pollution environnementale. Identification d'algues microscopiques nuisibles qui contaminent certaines ressources halieutiques.

Geographic scope (circle one)

global
 national
 regional
 local

If regional or local, what is the geographic area covered?

BIOGRAPHIES

Aiken, Susan G. Assistant Curator, Vascular Plants, Botany Division. Ph.D., University of Minnesota, 1979. Research interests: The Flora of the Canadian Arctic Islands; the grass genera Festuca and Zizania (Wild Rice); The Manual of North American Grasses; taxonomic problems in Myriophyllum; The Flora of North America project.

Argus, George W. Head, Vascular Plants Section, Botany Division. Ph.D., Biology, Harvard University, 1961. Research interests: Systematics of Salix, Rare and Endangered Plants.

Balkwill, E. Darlene. Acting Head, Zooarchaeology. M. Sc., Population Genetics and Evolutionary Biology, Carleton University, 1979. Research interests: interpreting past environments based on analysis of vertebrate remains, optimum sampling strategies for midden faunal assemblages, comparative osteology of Tetraoninae and Bovidae.

Bousfield, Edward L. Curator Emeritus, Crustaceans. Ph.D., Zoology, Harvard University, 1954. Research Interests: systematics, classification, and phylogeny of amphipod crustaceans; arthropod phylogeny; freshwater, estuarine, and intertidal ecology.

Brode, Irwin M. Curator of Lichens, Botany Division. Ph.D., Botany, Michigan State University, 1965. Research interests: Systematics of various lichen groups in North America, especially in the genera Lecanora, Ochrolechia, and Alectoria s. lato; floristic and phytogeographic studies of various parts of Canada, especially British Columbia, Ontario and the Arctic.

Chengalath, Rama Curator, General Invertebrates. M.Sc., Biology, University of Waterloo, 1971. Research interests: taxonomy, systematics and ecology of rotifers and littoral cladocerans; distribution and community structure of limnetic plankton.

Coad, Brian W. Curator, Ichthyology. Ph.D., Biology, University of Ottawa, 1976. Research interests: systematics, taxonomy and zoogeography of the freshwater fishes of Iran and the Middle East, of Canadian fishes and of members of the family Cyprinidae.

Conlan, Kathleen E. Associate Curator, Crustaceans. Ph.D., Biology, Carleton University, 1988. Research interests: systematics, behaviour and sexual reproduction and mating strategies of amphipods.

Cook, Francis Russel Curator, Herpetology. Ph.D., Zoology, University of Manitoba, 1978. Research interests: zoogeography, systematics, ecology and behaviour of northern nearctic amphibians and reptiles; evolutionary strategies and constraints in the Bufonidae; conservation and preservation of higher lower vertebrates (Amphibia, Reptilia).

Danks, H.V. Head, Biological Survey of Canada (Terrestrial Arthropods). Ph.D., Entomology, Imperial College, University of London, 1968. Research interests: modes of seasonal adaptation in insects, including dormancy and cold-hardiness; insect fauna of Canada; arctic insects; ecology of aquatic insects, especially Chironomidae.

Day, Richard G. Curatorial Assistant, Paleomycology. B.Sc. (Hons.), Biology, Carleton University, 1976. Research interests: Paleozoology and taxonomy of fossil fungi.

Ercit, T. Scott Research Curator, Ph.D. Mineralogy, University of Manitoba 1986. Research interests: Granitic pegmatites, oxide minerals, geochemistry of Ta and Nb.

Fitzgerald, Gerald R. Conservator, Paleobiology. M.Sc. Zoology, University of Durham, 1971. Especially interested in the conservation of fossil collections. Research into 1) the equilibrium moisture content of fossils and their stability under various levels of relative humidity; 2) Pleistocene birds of the Yukon.

Fournier, Judith A. Assistant Curator, Vermes. B.Sc. (Hons) Biology, University of Waterloo, 1967. Research Interests: taxonomy and systematics of polychaetous annelids; additional curatorial expertise in megadrile oligochaetes (earthworms), also chaetognaths, priapulids, and fossilized tube traces.

Gill, Bruce D. A/Curator, Entomology. Ph.D., Biology, Carleton University, 1986. Research interests: taxonomy and systematics of Coleoptera, especially Scarabaeidae; behavioral ecology and foraging strategies of detritus-feeding Coleoptera.

Gray, David R. Curator, Vertebrate Ethology. Ph.D., Zoology, University of Alberta, 1973. Research interests: ethology of mammals; behavioral adaptations to high arctic environments.

Grice, Joel D. Curator of Minerals. Ph.D., Mineralogy, University of Manitoba, 1973. Research interests: crystal chemistry, zeolites.

Haber, Erich Associate Curator of Vascular Plants, Botany Division. Ph.D., University of Toronto, 1972. Research interests: Systematics of the subfamily Pyroloideae (Ericaceae), in particular, the documentation of hybrids and the evaluation of species variability and the relationships between New World and Old World species groups.

Hamilton, Paul B. Curatorial Assistant, Phycology Section, Botany Division. M.Sc. Phycology, University of Waterloo, 1983. Research interests: Taxonomy and systematics of freshwater Bacillariophyceae and Rhodophyta, herbicide impacts in aquatic environments, phytoplankton preservation techniques.

Harrington, C.R. Curator of Quaternary Zoology, Ph.D. Zoology (Vertebrate Paleontology), University of Alberta, 1977. Research interests: Ice age mammals of northern North America, climatic change in Canada during the Quaternary.

Hendrycks, Edward A. Curatorial Assistant, Crustaceans. B.Sc. (Hons) Zoology, Carleton University, 1984. Research interests: systematics and behaviour of amphipods.

Ireland, Robert R. Curator of Bryophytes, Botany Division. Ph.D., Botany, University of Washington, 1966. Research interests: Taxonomy of Plagiotheciaceae, Hypnaceae and Dicranaceae, floristic and phytogeographic studies of the mosses of Ontario and the Maritime Provinces.

Jarrett, Norma E. Crustaceans. Undergraduate courses in Zoology, Carleton University, 1975-80. Research interests: taxonomy of gammaridean amphipod crustaceans.

Jarzen, David M. Palynologist and Curator of Fossil Plants. Ph.D. Geology/Palynology, University of Toronto, 1973. Research interests: Cretaceous-Tertiary Palynology, with emphasis on western North America and Australasian palynofloral distribution and paleophytogeographical relationships.

Laubitz, Diana R. Curator, Crustaceans. B.A., Zoology, Cambridge University, 1955. Research interests: taxonomy, systematics and zoogeography of the Caprellidea and related Gammaridea; the Crustacea Malacostraca fauna of Canada; the history of invertebrate research in Canada.

Madill, Jacqueline Assistant Curator, Vermes. B.Sc., Zoology (with Major in Biology), McGill University, 1971. Research interests: inter-departmental projects, environmental issues and research on taxonomy of Hirudinea.

McAllister, Don E. Research Curator, Ichthyology. Ph.D., Zoology, University of British Columbia 1964. Research interests: taxonomy of smelts, sculpins and northern blennies; arctic fishes; endangered fish species; conservation of coral reef ecosystems; adaptive evolution of fishes; hybridization and evolution; computerized list of fishes of the world; use of microcomputers in museums; geographic information systems and biogeography; biogeography and glaciation.

Ouellet, Henri Curator, Ornithology. Ph.D., Zoology, McGill University, 1977. Research interests: systematic, taxonomy, and zoogeography with special interests in Canadian and Neotropical birds.

Pirozynski, Kris A. Curator, Paleomycology. Ph.D., Botany, University of London, U.K., 1969. Research interests: Taxonomy of fossil and living fungi, coevolution of fungi with plants and animals, mycogeography.

Poulin, Michel. Conservateur, Section de Phycologie, Division de la botanique. Ph.D., Biologie, Université Laval, 1982. Intérêts: Taxonomie et systématique des Bacillariophyceae, biogéographie des diatomées de régions polaires.

Rafi, Fahmida Assistant Curator, Crustaceans. M. Sc., Zoology, Karachi University, Pakistan, 1955. Research interests: taxonomy and systematics of Malacostracan Crustacea (Isopoda, Tanaidacea and Cumacea).

Renaud, Claude B. Assistant Curator, Ichthyology, Ph.D., Biology, University of Ottawa, 1989. Research interests: systematics and ecology of lampreys (Petromyzontidae) and codfishes (Gadidae).

Robinson, George W. Curator of Minerals. Ph.D. Mineralogy, Queens University, 1979. Research interests: Phosphate minerals, amphiboles, fluid inclusion studies.

Russell, Dale A. Curator of Fossil Vertebrates (Dinosaurs). Ph.D. Geology/Paleontology, Columbia University, New York, 1964. Research interests: dinosaurian taxonomy, evolution, ecology and extinction.

Shih, Chang-tai Research Curator, Crustaceans. Ph.D. Zoology, McGill University, 1966. Research interests: Systematics and biology of Hyperiidia (Crustacea: Amphipoda) and Copepoda (Crustacea).

Still, Leslie A. Acting Assistant Head, Zooarchaeology. B.A., Anthropology, Trent University, 1981. Research interests: utilization of vertebrates by prehistoric subarctic peoples, and the reflection of changes in species ranges, environment, and climate.

van Zyll de Jong, Constantinus G. Curator, Mammalogy. Ph.D., Zoology, University of Toronto, 1968. Research interests: systematics of mammals (particularly insectivores & carnivores), evolution and zoogeography of holarctic mammals, morphometrics and biochemical systematics.

Waller, Robert R. Conservator. B.Sc. Computer Science and geology, University of Manitoba, 1976. Research interests: Stability of minerals and their preservation.

Wong, Pak Yau Curatorial Assistant, Botany Division. M.Sc. Lichen Ecology, Queen's University, 1969. Research interests: Lichen taxonomy, Lichen flora of Southern Ontario.

Youngman, Phillip M. Assistant Curator, Quaternary Zoology. Ph.D., Zoology, University of Helsinki, 1982. Research interests: 1) small carnivores of the Pleistocene of Beringia; 2) fossil and living mustelids; 3) Quaternary cave faunas.

PRAIRIE FARM REHABILITATION ADMINISTRATION

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: PETER FEHR

(306)
Telephone: 780-5071

Title: HEAD, SOIL CONSERVATION PLANNING SECTION, FERR
Address: 1901 VICTORIA AVE
REGINA SK
S4P0R5

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

SOIL QUALITY/NATURAL RESOURCE
MONITORING. SURVEYS ARE MADE
PERIODICALLY OF EROSION RISK POTENTIAL
BASED ON ~~SB~~ PRESENCE OR ABSENCE OF
CROP RESIDUE. DATA IS USED IN FARM
EXTENSION PROGRAMS TO PROMOTE LAND
RESOURCE PROTECTION FROM WIND & WATER
EROSION.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

WITHIN MY SECTION THERE ARE
4 SPECIALISTS INVOLVED IN PERIODIC
SURVEYS RELATED TO SOIL QUALITY
PARAMETERS SUCH AS SALINITY, EROSION
RISK AND LAND USE.

① BILL HARRON - SALINITY
② BROOK HARKER - "
③ MALCOLM BLACK - EROSION
④ ALLAN GAGLE - LAND USE

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

CROP RESIDUE SURVEY'S

Project Objective(s)

TO DETERMINE LEVEL OF CROP
RESIDUE ON VARIOUS SOILS AND RISK AREAS
FOR USE IN PREDICTING POTENTIAL WIND/WATER
EROSION HAZARDS IN SUCCEEDING YEAR.

Geographic scope (circle one)

global

national

regional

local

If regional or local, what is the geographic area covered?

PRAIRIE PROVINCES

STATISTICS CANADA

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: John Heimbecker

Telephone: 613-951-3838

Title: Analyst

Address: Census of Agriculture, Statistics Canada, Jean Talon Bldg.,
Tunney's Pasture, Ottawa K1A 0T6

1. Please describe the general purpose of your indicator research
(What mission/mandate/program does it contribute to? What use is
made of the indicator data?).

Five-year census: benchmark for annual surveys on agricultural
commodities and finances. Also gathers data on land management
practices (summer fallow, chemical and fertilizer use), farm labor and
machinery. Data is used in analysis of all aspects of agriculture.
Some data are suitable for such work as indirect indicators.

2. Use the attached sheets (one per project) to provide brief
descriptions of your major indicator research project(s). Make
additional copies of the form if you wish.

-
3. Can you suggest the names of other federal environmental indicator
researchers whom we should contact?

Ken Korporal, Remote Sensing Unit, Crops Section, Agriculture Div.,
Statistics Canada, 951-3872

Martha Fair, Health Div., Statistics Canada, 951-1734 (interested
in environmental issues)

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Census of Agriculture

Data Use/Activities: 1) for 1991--a new question on soil erosion control
2) number of livestock and poultry per farm--relates to the amount of manure (wastes/effluents)

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

All the data are published for Statistics Canada's standard geographic units: 1) census consolidated subdivision (quasi-municipal), 2) census division (like counties or regional districts), 3) provinces, 4) Canada, 5) enumeration areas (collection units below the census consolidated subdivision (data available subject to confidentiality)

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 - ③ 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 6. levels of contaminants in air, water or land;
 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Census of Agriculture

Project objective(s): 1) Farmers are asked if they use irrigation--this yields the number or percentage of farmers who irrigate. 2) Area of summer fallow--this can be seen as a measure of the use of soil. 3) Area subject to no-tillage cultivation. 4) Use of windbreaks and length of windbreaks and shelterbelts. 5) Farm energy use: amount of machinery; expenses for year--machinery fuel, heating fuel.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources;
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks;
- ☒ 5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Census of Agriculture

Data Use/Activities: 1) Total farm area, crop area, improved land area (size and distribution of arable land). 2) For 1991: presence of soil salinity as a problem (doesn't give area)

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

Please identify the category of indicator research which you believe the project falls within (circle one or more)

-
1. production of wastes, emissions or effluents from industry, transportation or other activities;
 2. rates of harvest and renewal of renewable natural resources;
 3. rates of extraction of non-renewable natural resources;
 4. quantity and distribution of renewable resource stocks;
 5. size and distribution of reserves of non-renewable resources;
 - ☒ 6. levels of contaminants in air, water or land;
 - ☒ 7. human exposure to toxic chemicals.
 8. contaminant levels in food; or
 - ☒ 9. exposure of fish and wildlife to toxic chemicals.

Name of Project: Census of Agriculture

Data Use/Activities: 1) Area treated by commercial fertilizers, herbicides and insecticides (all gathered separately). 2) New question for 1991: area for which chemicals are used on summer fallow land.

Geographic scope (circle one): global
national
regional
local

If regional or local, what is the geographic area covered?

ORGANIZATIONAL FRAMEWORK FOR SOE INDICATORS

A comprehensive set of SOE indicators would describe agents of environmental change (including human activities and natural processes) as well as environmental conditions (including environmental assets and quality).

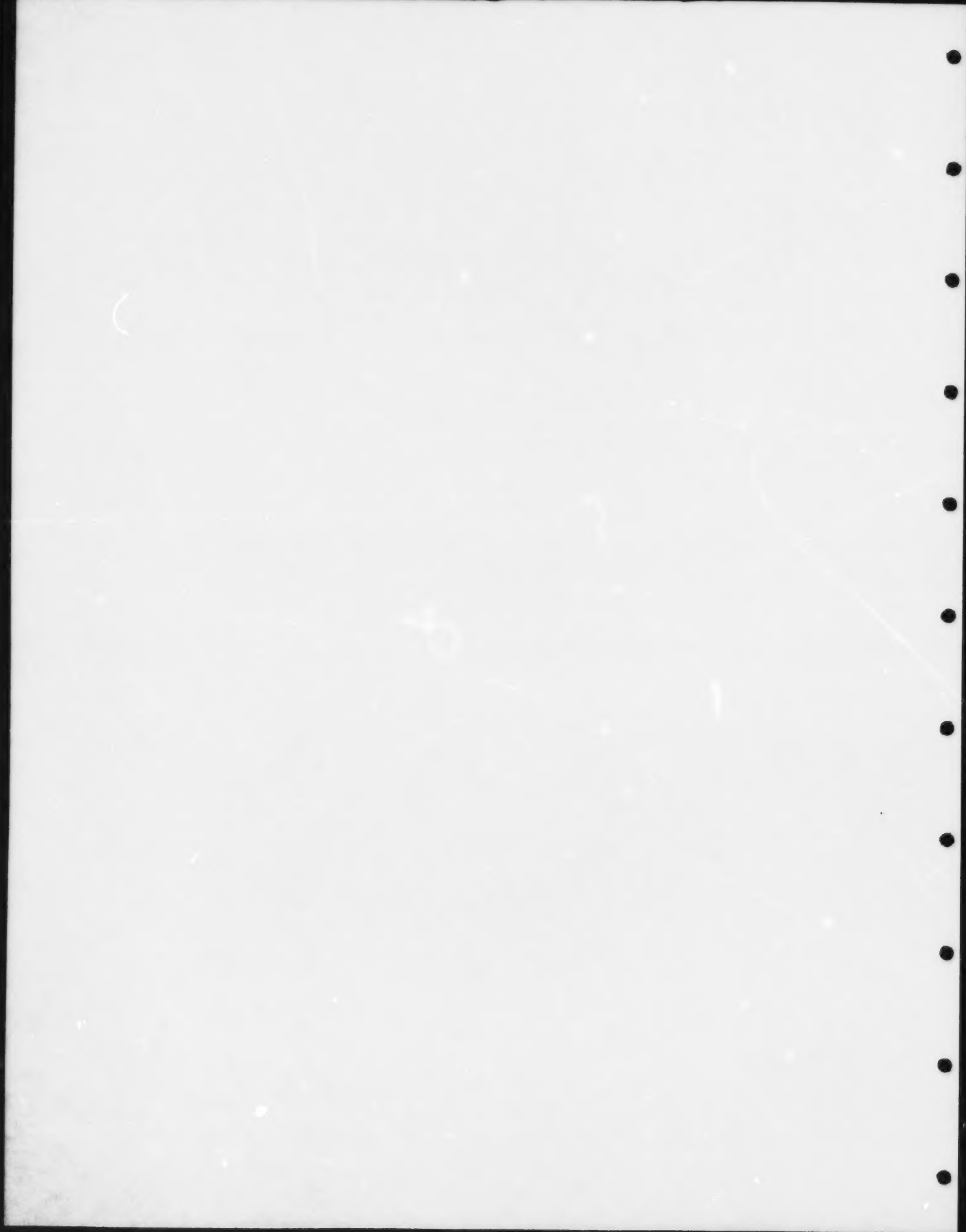
AGENTS OF ENVIRONMENTAL CHANGE	
HUMAN ACTIVITIES	EXAMPLES
Waste Generation by Sector and/or Waste Type	
. Mining and smelting	. Emissions, tailings production, effluent volumes
. Manufacturing	. Emissions, waste generation, effluent discharges
. Municipal	. Sewage effluent discharge, waste landfilled/incinerated/recycled
. Energy	. Emissions, waste generation
. Transportation	. Emission, spills
. Other	
Environmental Restructuring	
. Building	. Building starts and completions, land and habitat conversion
. Transportation	. Corridor construction, airports, land and habitat conversion
. Agriculture	. Land conversion, wetland drainage application of pesticides

Harvesting . Fisheries . Agriculture . Forestry . Hunting and Trapping Depletion of Non-Renewable Resources Other	. Catches by fish, fishery, zone; trends . Yield by commodity and area; trends . Tree harvest by area, replanted areas; trends . Wildlife harvest by species, area; trends . Mineral/ore/fuel production by region, province . Non-Agricultural pesticide application
<u>NATURAL PROCESSES</u> Major Events Major Fluctuations Other	<u>EXAMPLES</u> . Floods, droughts, fires, earthquakes, landslides, meteorological events, volcanic eruptions/fallout, tsunamis, avalanches . Trends in river and lake levels, trends in forest disease, climate change, changes in air, water and soil characteristics, natural landscape change, rates of erosion . Dust storms

ENVIRONMENTAL CONDITIONS

<u>ENVIRONMENTAL ASSETS/QUANTITY</u>	<u>EXAMPLES</u>
Water Resources	. Supply quantity and area statistics
Land Resources	. Supply quantity and area by classification
Forests	. Supply quantity and age statistics
Fisheries	. Population and stock size statistics
Wildlife	. Population and location statistics
Non-Renewable Resources	. Mineral and location statistics
Other	
<u>ENVIRONMENTAL QUALITY</u>	<u>EXAMPLES</u>
Air	. Levels and trends in air pollutants by region/pollutant
Water (freshwater and marine)	. Levels and trends in water polluting substances
Food	. Levels and trends of contaminants in foodstuffs
Human Health and Exposure	. Toxic substance analysis in body fluids, tissues
Soil	. Organic matter content, erosion rates, salinization, acidity, etc.
Precipitation	. Acid deposition rates

Fish and Wildlife Populations	• Toxic substance analysis and trends, population dynamics, species diversity, endangered species, occurrence of lesions and/or disease
Forests	• Forest depletion rate, cutting, restocking, species diversity, disease, pest, and fire trends
Landscape	• Critical land conversions such as prime agricultural land, protected areas and reserves
Other	
Source: (Modified from McRae, 1988, 8)	



This Appendix lists contact people within ten federal agencies which conduct environmental indicator research. The contacts were identified from the survey, for which the results are presented in Appendix II. Each listing in these tables includes the individual's name along with identification numbers for the projects for which he or she is responsible (see Appendix V for the numerical listing of projects by identification number).

Table 4-1

Federal Environmental Indicator Research

Agency Contacts: Agriculture Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
Blair McRae Environmental Projects Officer Pesticides Directorate Agriculture Canada SBI Bldg., 2nd Floor Ottawa, Ont. K1A OC6 993-4544	247, 248
John L. Nowland A/Director Land Resource Research Ctr. Research Br. Agriculture Canada Room 1141, K.W. Neatby Bldg. Ottawa, Ont. K1A OC6 995-5011, Ext. 7801	244-246
Robert Trottier Director Biosystematics Research Ctr. Agriculture Canada Ottawa, Ont. K1A OC6 996-1665	238-243

Table 4-2

Federal Environmental Indicator Research

Agency Contacts: Energy, Mines and Resources Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
R. Conn Manager, Petroleum Resources Economic and Financial Analysis Energy, Mines and Resources Canada 580 Booth St. Ottawa, Ontario K1A OE4 992-1194	68, 69
J.D. Hughes Coal Geologist Geological Survey of Canada 3303-33rd St., N.W. Calgary, Alberta T2L 2A7 403-284-0110	70
Neil McIlveen Director Energy & Fiscal Analysis Energy, Mines and Resources Canada 17th Floor, 580 Booth St. Ottawa, Ont. K1A OE4 995-5602	236
Dr. L.R. Snowdon Head, Geochemistry Subdivision Institute of Sedimentary and Petroleum Geology Energy, Mines and Resources Canada 3303-33rd St., N.W. Calgary, Alberta T2L 2A7 403-292-7035	14

Table 4-3

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
Dr. Glen D. Adams Research Scientist Canadian Wildlife Service 115 Perimeter Road Saskatoon, Sask. S7N 0X4 306-975-4093	256, 257
Wayne Barchard Head, Marine Assessment Section Conservation & Protection Atlantic Region Environment Canada B2Y 2N6 902-426-8304	234
S. Beltaos Rivers Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	76
D.W. Bissett Chief, Chemical Industries Div. Industrial Programs Br. Environment Canada Ottawa, Ontario K1A 0H3 953-8257	4-7

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
B. Braune Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr. Canadian Wildlife Service Environment Canada Ottawa, Ontario K1A OH3 953-5959	176
Dr. L. Buffa Chief, Mining, Mineral and Metallurgical Processes Div. Industrial Programs Br. Environment Canada 13th Floor Place Vincent Massey Ottawa, Ontario K1A OH3 953-1103	1
L.N. Carbyn Research Scientist Canadian wildlife Service Western and Northern Region 4999-98 Ave. Edmonton, Alta. T6B 2X3 403-435-7357	262
J.H. Carey Lakes Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	77

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
J.F. Carreiro Chief, Wildlife Conser- vation and Environmental Quality Ontario Region Canadian Wildlife Service 1725 Woodward Dr. Ottawa, Ontario K1A OH3 952-0931	177-183
M.N. Charlton Lakes Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	78
T. Dann Head, Air Toxics River Road Environmental Technology Ctr. Environment Canada Ottawa, Ont. K1A OH3 991-9459	273
Adrian Demayo Chief, Water Quality Assessments Inland Waters Dir. Environment Canada 7th Floor, Place Vincent Massey Ottawa, Ontario K1A OH3 997-1921	79

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
J. Desgranges Research Scientist Quebec Region Canadian Wildlife Service 1141 route de l'Eglise P.O. Box 10100, Ste-Foy, Quebec G1V 4H5 418-648-6126	184, 185
H. Loney Dickson Wildlife Biologist--Shorebirds Canadian Wildlife Service Western and Northern Region 2nd Floor, 4999-98 Ave. Edmonton, Alberta T6B 2X3 403-459-7893	261
Lynne Dickson Biologist Canadian Wildlife Service Western and Northern Region 2nd Floor, 4999-98 Ave. Edmonton, Alberta T6B 2X3 403-468-8924	186
D.W. Draper Chief, Oil Gas and Energy Div. Industrial Programs Br. Environment Canada 13th Floor, Place Vincent Massey Ottawa, Ontario K1A 0H3 953-1120	11-13

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
B.J. Dutka Rivers Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	80
J. Elliott Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr. Environment Canada Ottawa, Ont. K1A OH3 997-6075	187-191
W. Ernst Head, Pesticides and Ecological Effects Environmental Protection Environment Canada 15th Floor, Queen Square 45 Alderney Dr. Dartmouth, Nova Scotia B2Y 2N6 902-426-6141	81
G.A. Fox Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr. Ottawa, Ont. K1A OH3 997-6076	192-195

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
M. Guilcher Chief, Industrial and Shell- fish Programs Div. Environmental Protection Environmnet Canada 45 Alderney Dr. Dartmouth, Nova Scotia B2Y 2N6 902-426-6135	9, 82
L. Harding Manager, Marine and Estuarine Programs Environmental Protection Pacific and Yukon Region Environment Canada Kapilano 100--Park Royal West Vancouver, B.C. V7T 1A2 604-666-2917	83, 84, 122, 123
George S. Hochbaum Population Regulation Biologist Canadian Wildlife Service 501 University Cres. Winnipeg, Manitoba R3T 2E2 204-983-5247	258-260
C. Hyslop Coordinator, Nongame Birds and Latin American Program Canadian Wildlife Service Ottawa, Ontario K1A OH3	56

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
K.L.E. Kaiser Lakes Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	85
S. Kennedy Toxicology Research Div. National Wildlife Research Ctr. Environment Canada Ottawa, Ont. K1A OH3 997-6077	196, 197
Lawrence King Project Officer Conservation & Protection Ontario region, Ottawa District Office 49 Camelot Drive Nepean, Ont. K1A OH3 952-8679	269
D.C.L. Lam Rivers Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	86

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
T. Lash Chief, Endangered Species and Transboundary Wildlife Canadian Wildlife Service Ottawa, Ontario 953-4389	198
R.G. Lawford Chief, Hydrometeorological Research Div. 11 Innovation Blvd. Saskatoon, Sask. S7N 3H5 306-975-5775	270-272
G. Lee Chief, Habitat and Land Use Sustainable Development and SOE Branch Environment Canada 10th Floor, Place Vincent Massey Ottawa, Ontario K1A 0H3 953-1434	26
K. Lloyd Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr. Environment Canada Ottawa, Ont. K1A 0H3 997-6131	199, 200

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
R.J. Maguire Rivers Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	87
W.K. Marshall Chief, Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr. Environment Canada Ottawa, Ont. K1A OH3 997-3044	201
I. McLaurin A, Chief, Water Survey of Canada Div. Water Resources Br. Inland Waters Dir. Environment Canada 8th Floor, Place Vincent Massey Ottawa, Ontario K1A OH3 997-1474	22
S. McNair Atmospheric Environment Service Environment Canada 4905 Dufferin Street Downsview, Ontario M3H 5T4 416-739-4980	71

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
Frank L. Miller Research Scientist Canadian Wildlife Service Western and Northern Region 2nd Floor, 4999-98 Ave. Edmonton, Alta. T6B 2X3 403-468-8927	252
P. Mineau Toxic Substances Eval- uation and Monitoring Div. National Wildlife Research Ctr. Environment Canada Ottawa, Ont. K1A OH3 997-3045	202, 203
Bill Moores Head, Chemical Processes Section Environment Canada 4th Floor, Queen Sq. 45 Alderney Dr. Dartmouth, N.S. B2Y 2N6 902-426-2004	233, 235, 237
A. Mudroch Lakes Research Br. National Water Research Inst. Environment Canada P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	88

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
E.F. Muller Renewable Resources Extraction and Processing Div. Industrial Programs Br. Environment Canada Ottawa, Ontario K1A OH3 953-1138	10, 89
R. Norstrom Chief, Chemistry Research Div. National Wildlife Research Ctr. 997-1411	204-208
K. Novakowski Rivers Research Br. National Water Research Inst.	90
D.B. Peakall Chief, Toxicology Research Div. National Wildlife Research Ctr. 997-2780	209-211
P. Pilon Senior Hydrologist Water Resources Br. Inland Waters Dir. Ottawa 953-1547	23

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
R. Pratt Chief, Migratory Birds Conservation Ontario Region Canadian Wildlife Service Environment Canada 1725 Woodward Dr. Ottawa, Ontario K1A OH3 952-0932	57-59, 215
W.H. Prescott A/Chief, Migratory Bird Management Atlantic Region Canadian Wildlife Service Environment Canada P.O. Box 1590 Sackville, N.B. EOA 3CO 506-536-3025	20, 60-65, 216- 222
Dr. George Scotter Chief, Wildlife Conservation and Research Div. Canadian Wildlife Service No. 210-98th Ave. Edmonton, Alta T6B 2X3 403-468-8914	253-255
I. Sekerka Research and Applications Br. National Water Research Inst. P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4601	91

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
M.E.Still Head, Air Quality Services Liaison Office Atmospheric Environment Service Downsview, Ontario 416-739-4866	72-74
Dr. Ian Stirling Wildlife Conservation and Research Div. Canadian Wildlife Service + No. 210-98th Ave. Edmonton, Alta T6B 2X3 403-468-8914	250
W.M.J. Strachan Lakes Research Br. National Water Research Inst.	92
D.Tate Socio-Economic Div. Water Planning and Management Br. Inland Waters Dir. Ottawa 953-3478	24, 25
D.C. Thomas Research Scientist Canadian Wildlife Service Western & Northern Region 4999-98 ave., 2nd Floor Edmonton, Alta. T6B 2X3 403-435-7351	251

Table 4-3 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Environment Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
P. Thompson Ecotoxicologist Canadian Wildlife Service Quebec Region 418-648-5016	223
F. Vena Chief, Inventory Management Div. Environmental Protection Environment Canada Place Vincent Massey Ottawa, Ontario K1A 0H3 953-1656	2, 3, 75
S. Wetmore Chief, Migratory Birds Pacific and Yukon Region Canadian Wildlife Service P.O. Box 340 Delta, B.C. V4K 3Y3 604-946-8546	66, 67, 224- 228
E. Wiken Chief, Ecological Applications Research Div. Sustainable Development and SOE Branch Environment Canada Ottawa, Ont. K1A 0H3 997-1090	27

Table 4-4

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
P. Boudreau Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-3246	108
P.F. Brodie Bedford Institute Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-3246	109
K.T.J. Chang-Kue Resource Impact/Habitat Biologist Freshwater Inst. Department of Fisheries and Oceans 501 University Crescent Winnipeg, Manitoba R3T 2N6 204-983-5123	29

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
J. C. Davis Regional Director, Science Institute of Ocean Sciences Fisheries and Oceans Canada P.O. Box 6000 9860 West Saanich Rd. Sidney, B.C. V8L 4B2 604-356-6515	274-281
R. Dermott Fish Habitat Studies Div. Bayfield Inst. Department of Fisheries and Oceans 867 Lakeshore Blvd. P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4868	110
J.A. Elliott Director, Physical and Chemical Sciences Dir. Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-8478	111

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
Dr. R. Elner Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-3246	30
J.D. Fitzsimons Fish Habitat Studies Div. Bayfield Inst. Department of Fisheries and Oceans 867 Lakeshore Blvd. P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4862	112
W.G. Franzin Department of Fisheries and Oceans Central and Arctic Region 501 University Crescent Winnipeg, Manitoba R3T 2N6 204-983-5082	15, 16, 31, 113

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
J.N. Gearing Maurice Lamontagne Inst. Department of Fisheries and Oceans P.O. Box 1000 Mont-Joli, Quebec C5H 3Z4 418-775-6590	114-116
C. Gobeil Océanographe géo-chimiste Maurice Lamontagne Inst. 418-775-6591	117-120
D.C. Gordon Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-8478	121
G.C. Harding Bedford Institute 902-426-8478	124
B.T. Hargrave Bedford Institute 902-426-8478	125, 126

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
R. Hesslein Section Leader, Experimental Limnology Freshwater Inst. Department of Fisheries and Oceans 501 University Crescent Winnipeg, Manitoba R3T 2N6 204-983-5251	127, 131
P.V. Hodson Ecotoxicology Div. Bayfield Inst. Department of Fisheries and Oceans 867 Lakeshore Blvd. P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4864	132-134
Dr. O.E. Johannsson Fish Habitat Studies Div. Bayfield Inst. 416-336-4708	135
Dr. M.G. Johnson Fish Habitat Studies Div. Bayfield Inst. 519-371-0040	136

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
P.D. Kelzer Habitat Ecology Div. Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 902-426-8478	137
Dr. J.R.M. Kelso Fish Habitat Studies Div. Bayfield Inst. Department of Fisheries and Oceans 867 Lakeshore Blvd. P.O. Box 5050 Burlington, Ontario L7R 4A6 705-942-2848	138
S. Kerr Habitat Ecology Div. Bedford Institute 902-426-8478	140
M. Kingsley Chef, Division des mammifères marins et de la parasit- ologie Maurice Lamontagne Inst. Department of Fisheries and Oceans P.O. Box 1000 Mont-Joli, Quebec C5H 3Z4 418-775-6787	33-36, 141-143

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

A.H. Kristofferson 32
Fishery Management Biologist
Department of Fisheries
and Oceans
Central and Arctic Region
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

204-983-5159

G.L. Lacroix 144
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brate Fisheries Div.
Department of Fisheries and Oceans
Biological Station
St. Andrews, N.B.
EOG 2XO

506-529-4517

P. Lawton 37, 38
Aquaculture and Invertebrate
Fisheries Div.
Department of Fisheries and Oceans
Biological Station
St. Andrews, N.B.
EOG 2XO

506-529-4517

M. Mercer 39-41, 145-148
Regional Director, Science
Newfoundland Region
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Nfld.
A1C 5X1

709-772-2027

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

Dr. R. Miller Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 506-529-4517	42
M. Munawar Ecotoxicology Div. Bayfield Inst. Department of Fisheries and Oceans 867 Lakeshore Blvd. P.O. Box 5050 Burlington, Ontario L7R 4A6 416-336-4867	149
H.B. Nicholls Head, Marine Assessment and Liaison Div. Bedford Institute of Oceanography 506-529-4517	43, 44, 150
D.L. Peer Habitat Ecology Div. Bedford Institute 902-426-8478	151
R.H. Peterson Aquaculture and Inverte- brate Fisheries Div. Biological Station St. Andrews, N.B. 506-529-4517	152

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

P. Richard 45
Marine Mammal Management
Biologist
Department of Fisheries
and Oceans
Central and Arctic Region
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

204-983-5162

Bill Ritchie 263-268
Gulf Region, Science Br.
Department of Fisheries
and Oceans
P.O. Box 5030
Moncton, N.B.
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506-857-6230

G. Robert 46
Marine Assessment
and Liaison Div.
Bedford Institute of
Oceanography
Department of Fisheries and
Oceans
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

506-529-4517

S.M.C. Robinson 47, 48
Department of Fisheries and
Oceans
Biological Station
St. Andrews, N.B.
EOG 2X0

506-529-4517

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

M. Roddick Bedford Institute of Oceanography Department of Fisheries and Oceans P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2 506-529-4517	49
T.W. Rowell Habitat Ecology Div. Bedford Institute 506-529-4517	50, 153
G. Sharp Bedford Institute 506-529-4517	154
A. Sinclair Chef, Division de la recherche sur les pêches Department of Fisheries and Oceans Quebec Region 418-775-6643	51
J.E. Stewart Habitat Ecology Div. Bedford Institute 506-529-4517	155, 156

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

Dr. R. Stewart
Freshwater Inst.
501 University Cres.
Winnipeg, Man.
R3T 2N6

157

204-983-5023

J.T. Strong
Marine Mammals Management
Biologist
Department of Fisheries
and Oceans
Central and Arctic Region

52, 53

204-983-5162

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Oceans
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

158, 159

506-529-4517

J.C. Therriault
Chef, Division de
l'océanographie biologique
Department of Fisheries and
Oceans
Quebec Region

54, 55, 160

418-775-6595

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

P. Thompson Manager, Commercial Analysis and Statistics Program Co-ordination and Economics Br. Department of Fisheries and Oceans Central and Arctic Region 501 University Crescent Winnipeg, Manitoba R3T 2N6 204-983-5227	17
G.H. Tremblay Maurice Lamontagne Inst. Department of Fisheries and Oceans P.O. Box 1000 Mont-Joli, Quebec C5H 3Z4 418-775-6593	161
G. Walsh Chef interimaire Division de l'Habitat du poissons Maurice Lamontagne Inst. 418-775-6593	162, 169
W.D. Watt Biologist Department of Fisheries and Oceans P.O. Box 550 Halifax, Nova Scotia B3J 2S7 902-426-3606	170

Table 4-4 (cont'd.)

Federal Environmental Indicator Research

Agency Contacts: Fisheries and Oceans Canada

D.M. Whittle 171
Ecotoxicology Div.
Bayfield Inst.
Department of Fisheries and
Oceans
867 Lakeshore Blvd.
P.O. Box 5050
Burlington, Ontario
L7R 4A6

416-336-4565

D.J. Wildish 172
Department of Fisheries and Oceans
Biological Station
St. Andrews, N.B.

506-529-4517

P.T.S. Wong 139
Ecotoxicology Div.
Bayfield Inst.

416-336-4559

Table 4-5

Federal Environmental Indicator Research

Agency Contacts: Forestry Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
Brian Haddon FORSTATS Coordinator Forestry Canada 20th Floor Place Vincent Massey Ottawa, Ontario K1A 1G5 997-1107	19, 28, 229- 230
Joe J. Lowe Manager, Forest Inventory Project Petawawa National Forestry Institute Forestry Canada Box 2000 Chalk River, Ontario K0J 1J0 613-589-2880	231
Dr. B.H. Moody FIDS Coordinator Science Directorate Forestry Canada 21st Floor Place Vincent Massey Ottawa, Ontario K1A 1G5 997-1107	232

Table 4-6

Federal Environmental Indicator Research

Agency Contacts: Health and Welfare Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
Dr. H.B.S. Conacher Chief, Food Research Div. Health Protection Br. Health and Welfare Canada 3rd Floor East Sir Frederick Banting Bldg. Tunney's Pasture, Ottawa K1A OL2 957-0944	93-96
Dr. F. Iverson A/Chief, Toxicology Research Div. 2nd Floor East Sir Frederick Banting Bldg. Tunney's Pasture, Ottawa K1A OL2 957-0987	97-100
M.E. Meek Health Protection Br. Health and Welfare Canada Environmental Health Ctr. Tunney's Pasture Ottawa, Ontario K1A OL2	101
D. Meyerhof Health Protection Br. Health and Welfare Canada Tunney's Pasture 954-6672	102

Table 4-6

Federal Environmental Indicator Research

Agency Contacts: Health and Welfare Canada

<u>Agency Contact</u>	<u>Project Number(s)</u>
R. Otson Health Protection Br. Health and Welfare Canada Environmental Health Ctr. Tunney's Pasture Ottawa, Ontario K1A OL2 957-1646	103
M. Raizenne Health Protection Br. Health and Welfare Canada Tunney's Pasture 957-1877	104
J. Sitwell Health Protection Br. Health and Welfare Canada Tunney's Pasture 957-1501	105
D.C. Villeneuve Health Protection Br. Health and Welfare Canada Tunney's Pasture 957-1837	106
F. Wandelmaier Health Protection Br. Health and Welfare Canada Tunney's Pasture 957-1854	107

Table 4-7

Federal Environmental Indicator Research

Agency Contacts: National Energy Board

<u>Agency Contact</u>	<u>Project Number(s)</u>
David Collyer Director, Energy Supply Br. National Energy Board 473 Albert St. Ottawa, Ontario K1A OE5 998-7952	21

Table 4-8

Federal Environmental Indicator Research

Agency Contacts: National Museum of Natural Sciences

<u>Agency Contact</u>	<u>Project Number(s)</u>
E.D. Balkwill A/Head, Zooarcheological Identification Ctr. National Museum of Natural Sciences 990-6410	173, 174
D.A. Bondy A/Chief, Zoology Div. National Museum of Natural Sciences P.O Box 3443, Station D Ottawa, Ontario K1P 6P4 954-7676	175
Dr. M. Poulin Chief, Botany Div. National Museum of Natural Sciences 990-6454	212-214

Table 4-9

Federal Environmental Indicator Research

Agency Contacts: Prairie Farm

Rehabilitation Administration

Agency Contact

Project Number(s)

Peter Fehr
Head, Soil Conservation
Planning Section
Prairie Farm Rehabilitation
Admin.
1901 Victoria Ave.
Regina, Sask.
S4P OR5

249

306-780-5071

This appendix lists federal environmental indicator research projects in numerical order based on the identification numbers assigned for this study. The appropriate agency contact is given for each project.

Abbreviations used in the table:

AC: Agriculture Canada
DFO: Fisheries and Oceans Canada
DOE: Environment Canada
EMR: Energy, Mines and Resources Canada
FC: Forestry Canada
HWC: Health and Welfare Canada
NEB: National Energy Board
NMNS: National Museum of Natural Sciences
PFRA: Prairie Farm Rehabilitation Administration
SC: Statistics Canada

Table V-1

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
1	Identification of metals released by 13 major metallurgical operations	Dr. L. Buffa	DOE
2	National Inventory of CO ₂	F. Vena	DOE
3	Inventory of Common Pollutants	F. Vena	DOE
4	VOC Inventory from Chemical Plants	D.W. Bissett	DOE
5	Status Report on Compliance with the Chlor-alkali Mercury Regulations	D.W. Bissett	DOE
6	Status Report on the Vinyl Chloride Industry	D.W. Bissett	DOE
7	Environmental Assessment of the Canadian Textile Industry	D.W. Bissett	DOE
8	Taxonomy and Ecology of Polychaete Worms	D.A. Bondy	NMNS
9	Industrial/Municipal Pollution	M. Guilcher	DOE
10	1987 Status of Emission Controls of Pulp and Paper Mills	E.F. Muller	DOE
11	Control options for SO ₂ --Major Fossil Fuel Combustion Sources	D.W. Draper	DOE
12	Control options for CO ₂ --Major Fossil Fuel Combustion Sources	D.W. Draper	DOE
13	Control options for NO _x /VOC	D.W. Draper	DOE
14	Environmental Geochemistry	L.R. Snowdon	EMR
15	High Arctic coastal fisheries for Arctic char	W.G. Franzin	DFO
16	Monitoring of the Lancaster Sound narwhal hunt	W.G. Franzin	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
17	Economic analysis and studies to support regional fisheries planning and management	P. Thompson	DFO
18	Census of Agriculture	J. Heimbecker	SC
19	FORSTATS Program: Forest Management Statistics	B. Haddon	FC
20	Migratory Bird Management (Note that although Mr. Prescott was the only survey respondent who described a Migratory Bird Management project, each CWS region should have a similar program)	W.H. Prescott	DOE
21	Canadian Energy Supply and Demand report	David Collyer	NEB
22	Water Survey of Canada	I. McLaurin	DOE
23	WMO Time Analysis of Long-Term Hydrometric Stations (analyzing the variability of streamflow)	P. Pilon	DOE
24	Industrial Water Use Survey	D.Tate	DOE
25	Municipal Water Use Survey	D.Tate	DOE
26	Wildlife Habitat Conservation Strategy	G. Lee	DOE
27	Ecological Resource Data Bases (ecozones; ecoprovinces, ecoregions; ecodistricts; ecoclimatic provinces and regions)	E. Wiken	DOE
28	FORSTATS Program: Forest Resource Dynamics Data	B. Haddon	FC
29	Coastal Coregonid Migrations	K. Chang-Kue	DFO
30	Cape Breton crab assessments and research	Dr. R. Elner	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
31	Arctic Cisco 1 Migrations and Life History	W.G. Franzin	DFO
32	Fish and Marine Mammal Management: Coastal Fisheries	A.H. Kristof- ferson	DFO
33	Great whales	M. Kingsley	DFO
34	Odontocete research	M. Kingsley	DFO
35	Gulf pinniped ecology research	M. Kingsley	DFO
36	Arctic pinnipeds	M. Kingsley	DFO
37	Lobster stock assessment	P. Lawton	DFO
38	Lobster research: juvenile and adult field studies	P. Lawton	DFO
39	biological studies and assessments for groundfish	M. Mercer	DFO
40	biological studies and assessments for pelagic fish, shellfish and marine mammals	M. Mercer	DFO
41	biological studies and assessments for freshwater and anadromous fish	M. Mercer	DFO
42	Lobster assessments and related research	Dr. R. Miller	DFO
43	Grey and harbour seal assessment and ecology	H.B. Nicholls	DFO
44	Fish stock assessment and ecology	H.B. Nicholls	DFO
45	Assessment of beluga, narwhal and walrus populations (distribution and abundance) in relation to their use	P. Richard	DFO
46	Scallop assessment and research	G. Robert	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
47	Soft-shell clam ecology and fishery research	S. Robinson	DFO
48	Scallop population dynamics and fishery research	S. Robinson	DFO
49	Offshore clam assessments and research	M. Roddick	DFO
50	Inshore clam stock assessment and related research	T.W. Rowell	DFO
51	Biological studies and stock assessments for various fish species	A. Sinclair	DFO
52	Beaufort Sea Beluga Project	J.T. Strong	DFO
53	Lancaster Sound Narwhal Project		
54	Communautés ichtyoplanctoniques dans le Golfe Saint-Laurent: Associations multispecifiques et interactions trophiques	J. Therriault	DFO
55	Alimentation et distribution de larves de Sébaste par rapport à la productivité du copepode planctonique, <u>Calanus finmarchicus</u>	J. Therriault	DFO
56	Data base on Nongame Migratory Bird Populations	C. Hyslop	DOE
57	Colonial Waterbirds of the Great Lakes Basin	R. Pratt	DOE
58	Ontario Waterfowl Population Assessment	R. Pratt	DOE
59	Status of migratory birds (song-birds)	R. Pratt	DOE
60	Non-Game Bird Surveys	W.H. Prescott	DOE
61	Duck Population Monitoring	W.H. Prescott	DOE

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
62	Harlequin and Peregrine Surveys-- Labrador	W.H. Prescott	DOE
63	Shorebird Banding in the Bay of Fundy	W.H. Prescott	DOE
64	Monitoring Population Trends and Breeding Performance of Seabirds in Atlantic Waters	W.H. Prescott	DOE
65	Black Duck Research	W.H. Prescott	DOE
66	Seabird colony inventory	S. Wetmore	DOE
67	Waterfowl breeding pair survey	S. Wetmore	DOE
68	Western Basin Natural Gas Study	R. Conn	EMR
69	Mackenzie Delta/Beaufort Sea Economic Analysis	R. Conn	EMR
70	National Coal Inventory for Canada	J.D. Hughes	EMR
71	Canadian Air and Precipitation Monitoring Network (CAPMoN)	S. McNair	EMR
72	Carbon Dioxide Monitoring	M.E.Still	DOE
73	Tropospheric Ozone Monitoring	M.E.Still	DOE
74	Stratospheric Ozone Monitoring	M.E.Still	DOE
75	Analysis of Urban Air Quality Trends	F. Vena	DOE
76	River Modelling Project	S. Beltaos	DOE
77	Nutrient/Contaminant Interactions Project	J.H. Carey	DOE
78	Lakes Restoration Project	M.N. Charlton	DOE
79	Water Quality Indices	Adrian Demayo	DOE
80	Ecotoxicology Project	B.J. Dutka	DOE

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
81	Measurement of impacts of pesticides/toxic chemicals	W. Ernst	DOE
82	Shellfish Program	M. Guilcher	DOE
83	Contaminant Data Management/Display	L. Harding	DOE
84	Sediment Quality Triad	L. Harding	DOE
85	Nearshore/Offshore Interactions Project	K.L.E. Kaiser	DOE
86	Long Range Transport of Airborne Pollutants Project	D.C.L. Lam	DOE
87	Contaminants/Pesticides Project	R.J. Maguire	DOE
88	Sediment/Water Interactions Project	A. Mudroch	DOE
89	National Sampling Program for Dioxins/Furans in Sediments and Fish	E.F. Muller	DOE
90	Groundwater Contamination Project	K. Novakowski	DOE
91	Analytical Chemistry Project	I. Sekerka	DOE
92	Air/Water Interactions Project	W. Strachan	DOE
93	Assessment of Effluents from Pulp/Paper Mills	H. Conacher	HWC
94	General monitoring of selected foods	H. Conacher	HWC
95	National Human Breast Milk Survey	H. Conacher	HWC
96	Total Diet Survey		
97	Chronic Toxicity of Vomitoxin (deoxynivalenol), a mycotoxin	F. Iverson	HWC

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
98	Systemic Toxicity of Shellfish toxins	F. Iverson	HWC
99	Teratogenic potential of chemicals	F. Iverson	HWC
100	Toxicity of Polychlorinated Biphenyls to Primates (Rhesus monkeys)	F. Iverson	HWC
101	Drinking Water	M.E. Meek	HWC
102	Environmental Radioactivity and Human Health Monitoring	D. Meyerhof	HWC
103	Indoor Air Quality and Energy	R. Otson	HWC
104	Long-Range Transport of Air Pollutants	M. Raizenne	HWC
105	Industrial and Commercial Chemicals	J. Sitwell	HWC
106	Environmental Pollutants	D. Villeneuve	HWC
107	Pesticides	F. Wandelmaier	HWC
108	Application of Acoustics to Habitat management	P. Boudreau	DFO
109	Bioenergetics of Marine Mammals	P.F. Brodie	DFO
110	Benthic Habitat Concerns, Bay of Quinte and Eastern Lake Ontario	R. Dermott	DFO
111	Marine Chemistry Division: determination of inorganic and organic chemical distributions in the marine environment	J.A. Elliott	DFO
112	Slimy Sculpin Tumor Monitoring	J. Fitzsimons	DFO
113	Nanisivik and Polaris Mine Monitoring Program	W.G. Franzin	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
114	Geochimie organique du Saint-Laurent--Variations spatio-temporelles enregistrees dans les sediments	J.N. Gearing	DFO
115	Géochimie organique du Saint-Laurent--Variabilite de la matière organique en suspension	J.N. Gearing	DFO
116	Procédés biologique et chimique affectant les abondances naturelles du C-13 et N-15	J.N. Gearing	DFO
117	Accumulation et cycle du plomb dans les sédiments en milieu marin cotier	C. Gobeil	DFO
118	Role de l'interface eau-sediment dans le cycle du phosphore en milieu marin	C. Gobeil	DFO
119	Distribution et diagenese du mercure dans les sédiments du chenal Laurentien	C. Gobeil	DFO
120	L'arsenic dans le fjord du Saguenay	C. Gobeil	DFO
121	Fish Habitat Assessment Advice	D.C. Gordon	DFO
122	(This number was not used.)		
123	Vancouver Harbour	L. Harding	DOE
124	Zooplankton Habitat Studies	G.C. Harding	DFO
125	Contaminant Fluxes in Marine Food Webs	B.T. Hargrave	DFO
126	LRTAP Organic Studies	B.T. Hargrave	DFO
127	Whole lake acidification studies and recovery from acid conditions	R. Hesslein	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
128	Wetland acidification studies	R. Hesslein	DFO
129	Whole lake cadmium study	R. Hesslein	DFO
130	Using stable isotopes of carbon, nitrogen and sulfur as indicators of food web structure and migration patterns of fish	R. Hesslein	DFO
131	Food chain manipulation studies-- top predator introduction	R. Hesslein	DFO
132	Biochemical Indicators of Chemical Effects on Fish	P.V. Hodson	DFO
133	Hamilton Harbour Rehabilitation-- Contaminants Assessment	P.V. Hodson	DFO
134	Indicateurs de toxicité dans le poisson (with DFO Quebec Region)	P.V. Hodson	DFO
135	Long Term Biological Program-- Lake Ontario	O. Johannsson	DFO
136	Zooplankton and Larval Whitefish in Lake Huron	M.G. Johnson	DFO
137	Benthic/Pelagic Exchanges	P.D. Keizer	DFO
138	LRTAP--Turkey Lakes Calibrated Watershed and Biomonitoring	J.R.M. Kelso	DFO
139	Biochemical Indicator in Aquatic Ecosystems: Adenine Nucleotides	P.T.S. Wong	DFO
140	Size-dependent and bioenergetic Processes in Fish Production Habitats	S. Kerr	DFO
141	Contamination chez le marsouin commun	M. Kingsley	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
142	Revue de la documentation sur les effets des PBC et des HAP sur le systeme immunitaire	M. Kingsley	DFO
143	(This number was not used.)		
144	Impacts of Acid Rain on Salmonid Ecology	G.L. Lacroix	DFO
145	Habitat Research and Assessment	M. Mercer	DFO
146	Acid Precipitation Studies	M. Mercer	DFO
147	Disease Research	M. Mercer	DFO
148	Toxicology and Contaminants	M. Mercer	DFO
149	Rapid Toxicity Testing of Contaminants Associated with Sediments and Effluents in the Great Lakes	M. Munawar	DFO
150	Carbon Dioxide and Climate: Biogeochemical Cycles in the Ocean	H.B. Nicholls	DFO
151	Benthic Habitat Studies	D.L. Peer	DFO
152	Effects of Low pH on Salmonid Development	R.H. Peterson	DFO
153	Inshore Molluscan Habitat Studies	T.W. Rowell	DFO
154	Marine Plant Assessment and Research	G. Sharp	DFO
155	Microbial Ecology	J.E. Stewart	DFO
156	Molluscan Toxins I		
157	Arctic Marine Mammal Ecology and Assessment Research	R. Stewart	DFO
158	Molluscan Toxins II	D. Subba Rao	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
159	Role of Picoplankton in the Marine Ecosystem	D. Subba Rao	DFO
160	Relations trophiques et cheminement des contaminants dans la chaine trophique de l'estuaire du Saint-Laurent	J. Therriault	DFO
161	Analyse des contaminants dans les sédiments	G.H. Tremblay	DFO
162	Effets sous-létaux des conditions environnementales dans le fleuve Saint-Laurent	G. Walsh	DFO
163	Analyse des contaminants présents dans le poisson de L'Estuaire moyen du Saint-Laurent	G. Walsh	DFO
164	Etude à long terme de la réponse a l'acidification des communautés biologiques de 4 ecosystèmes lacustres du bouclier canadien	G. Walsh	DFO
165	Toxicité des fluoro-complexes d'aluminium vis-à-vis du saumon atlantique	G. Walsh	DFO
166	Etude des effets sous-létaux de l'acidification printanière sur le saumon atlantique	G. Walsh	DFO
167	Etude à long terme de la réponse des communautés benthiques des rivières à saumon de la Côte-Nord face à l'acidification	G. Walsh	DFO
168	Evaluation de habitats des rivières à saumon de la Cote-Nord vulnérables à l'acidification	G. Walsh	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
169	Paléo-écologie de l'acidification recent de lacs de l'est du Canada	G. Walsh	DFO
170	Biomonitoring long range transport of air pollutants	W.D. Watt	DFO
171	Great Lakes Contaminants Surveillance	D.M. Whittle	DFO
172	Aquaculture Ecology Research	D.J. Wildish	DFO
173	Duck Stomach Contents	E.D. Balkwill	NMNS
174	Caspian Tern Pellet Analysis	E.D. Balkwill	NMNS
175	Impacts of Acidification on Littoral Microcrustacea	D.A. Bondy	NMNS
176	National Survey of Contaminants in Waterfowl	B. Braune	DOE
177	Annual monitoring of contaminant levels and bioeffects in fish-eating birds on the Great Lakes: I. Contaminant Levels in Herring Gull Eggs	J.F. Carreiro	DOE
178	Annual monitoring of contaminant levels and bioeffects in fish-eating birds on the Great Lakes: II. Congenital Anomalies in Embryonic and Post-hatch Double-crested Cormorants	J.F. Carreiro	DOE
179	Annual monitoring of contaminant levels and bioeffects in fish-eating birds on the Great Lakes: III. Breeding Biology of Herring Gulls and Foster's Terns on Walpole Island	J.F. Carreiro	DOE
180	Lower Great Lakes Basin Wetlands at Risk	J.F. Carreiro	DOE

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
181	Wildlife and Agricultural Pesticides in Southern Ontario: I. Bird usage of Agricultural Fields	J.F. Carreiro	DOE
182	Wildlife and Agricultural Pesticides in Southern Ontario: II. Breeding Biology Parameters of Swallows, Bluebirds, and Kestrels nesting near Apple Orchards along the Niagara Escarpment	J.F. Carreiro	DOE
183	Wildlife support for Remedial Action Plans for Great Lakes Areas of Concern	J.F. Carreiro	DOE
184	Use of Fledging Osprey Feathers to Monitor Mercury Contamination in the James Bay Hydroelectric Reservoirs	J. Desgranges	DOE
185	Contaminant Bio-monotoring Program for the St. Lawrence River Fauna	J. Desgranges	DOE
186	Monitoring Study: Impact of Oil Development on Birds in the Beaufort Sea Region	Lynne Dickson	DOE
187	Contaminants Monitoring, Development and Coordination	J. Elliott	DOE
188	Survey of Contaminants (PCDDs, PCDFs, OCs, Hg) in Snapping Turtle Eggs from Lake Ontario and the St. Lawrence River	J. Elliott	DOE
189	Organochlorine Levels and Effects in Eggs of Accipiter Hawks	J. Elliott	DOE
190	Monitoring Organochlorine in Plasma of Migratory Raptors	J. Elliott	DOE

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
191	Toxicological Studies of PCB Isomers in Japanese Quail and American Kestrels: Porphyria and Enzyme Induction	J. Elliott	DOE
192	Studies on the prevalence, nature and causes of developmental abnormalities and reduced hatching success of avian embryos	G.A. Fox	DOE
193	Great Lakes Bioeffects Data Review/write-up	G.A. Fox	DOE
194	Is the diet and embrionic milieu of Great Lakes herring gulls and cormorants in the Great Lakes and great blue herons in B.C. deficient in iodine and vitamin A?	G.A. Fox	DOE
195	Detection of early embryonic death and infertility in eggs	G.A. Fox	DOE
196	Avian liver Cell Culture Studies of the Mixed Function Oxidase and Porphyria Inducing Potencies of Polyhalogenated Aromatic Hydrocarbons	S. Kennedy	DOE
197	Biochemical approaches to the differential diagnosis of bird exposure to organophosphates and Carbamates	S. Kennedy	DOE
198	Endangered Species/Biological Diversity	T. Lash	DOE
199	Pesticide registration reviews of new active ingredients and research permits in support of Pest Control products Act	K. Lloyd	DOE

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
200	Special reviews of pesticide impacts on wildlife for registered pesticides identified as a priority by CWS	K. Lloyd	DOE
201	Priority and new substance hazard evaluations	W.K. Marshall	DOE
202	Evaluation of the utility of the avian reproduction studies currently provided as part of pesticide registration	P. Mineau	DOE
203	The Sublethal Effects of an Organophosphate Insecticide on Learning and Memory in Birds	P. Mineau	DOE
204	Contaminant Dynamics and Trends in Great Lakes Herring Gulls	R. Norstrom	DOE
205	Dioxins in wildlife	R. Norstrom	DOE
206	Qualitative GC-MS Identification of Contaminants in Wildlife	R. Norstrom	DOE
207	Toxic PCBs in the environment	R. Norstrom	DOE
208	Long Range Transport and Accumulation of Organochlorine Contaminants in Arctic Marine Ecosystems	R. Norstrom	DOE
209	Biochemical methods to assess exposure of birds to toxicants	D.B. Peakall	DOE
210	Effects of Toxic Chemicals in the Great Lakes Ecosystem	D.B. Peakall	DOE
211	Studies of pollutant effects on DNA	D.B. Peakall	DOE
212	Plantes vasculaire du Canada	Dr. M. Poulin	NMNS
213	Lichens du Canada	Dr. M. Poulin	NMNS

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
214	Diatomes marines et dulcicoles du Canada	Dr. M. Poulin	NMNS
215	Effects of Acidic Precipitation on Waterfowl Populations of Northern Ontario	R. Pratt	DOE
216	Populations, Bioenergetics and Feeding Ecology of the Common Eider in Southwestern New Brunswick	W.H. Prescott	DOE
217	Research on Breeding and Feeding Ecology of Colonial Seabirds	W.H. Prescott	DOE
218	Pelagic Ecology of Seabirds in Atlantic Waters	W.H. Prescott	DOE
219	Forest Bird Research	W.H. Prescott	DOE
220	Toxic Chemicals--General and Pesticides Impact of Toxic Chemicals and Pesticides on Migratory Birds	W.H. Prescott	DOE
221	Lead Shot Effects	W.H. Prescott	DOE
222	The Effects of Acid Precipitation on Watersheds and Wetland Habitats in Nova Scotia	W.H. Prescott	DOE
223	Impact of Dioxin/Furan Exposure from a BKM Effluent on Fish-eating Birds of the St. Maurice River	P. Thompson	DOE
224	Dioxins in Great Blue Herons, Cormorants and Diving Ducks in	S. Wetmore	DOE
225	Monitoring the impact of agricultural pesticides on birds in the Strait of Georgia, B.C.	S. Wetmore	DOE
226	Monitoring organochlorine and heavy metals in hunted waterfowl in the Pacific and Yukon Region	S. Wetmore	DOE

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
227	Survey of ingested lead shot in hunted waterfowl in B.C. and Yukon	S. Wetmore	DOE
228	West Coast Seabird Monitoring Program	S. Wetmore	DOE
229	(This number was not used.)		
230	(This number was not used.)		
231	FORSTATS Program: Forest Inventory Project	Joe J. Lowe	FC
232	Forest Insect and Disease Survey Coordination	B.H. Moody	FC
233	Source Regulations--Toxic Substances	Bill Moores	DOE
234	Spill Trends Data Base	W. Barchard	DOE
235	Fuels Regulations	Bill Moorea	DOE
236	Greenhouse Gas Emissions from Energy Use in Canada	N. McIlveen	EMR
237	LRTAP Monitoring--Oxidants	Bill Moores	DOE
238	Plant Gene Resource	R. Trottier	AC
239	Economic Plants	R. Trottier	AC
240	Economic Fungi	R. Trottier	AC
241	Soil and Water Organisms	R. Trottier	AC
242	Beneficial Insects	R. Trottier	AC
243	Insect Pests	R. Trottier	AC
244	Evaluation of Some Selected Selected Methodologies for Soil Quality Monitoring and Data Collection	J.L. Nowland	AC

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
245	Loss of Soil Quality by Erosion	J.L. Nowland	AC
246	Soil Quality Evaluation System for Assessing Agricultural Sustainability in Canada	J.L. Nowland	AC
247	Identification and characterization of potentially leachable pesticides and areas in Canada vulnerable to groundwater contamination by pesticides	Blair McRae	AC
248	Water Residue Investigation Program	Blair McRae	AC
249	Crop Residue Surveys	Peter Fehr	PFRA
250	Polar Bear Ecology	I. Stirling	DOE
251	Effects of Forest Fires on the Winter Range of the Beverly Herd of Barren-Ground Caribou	D.C. Thomas	DOE
252	Peary Caribou Conservation	F.L. Miller	DOE
253	Loggerhead Shrike Conservation	G.Scotter	DOE
254	Integration of Migratory Bird and Timber Management	G. Scotter	DOE
255	Remote Sensing Studies	G. Scotter	DOE
256	Prairie Pothole Project--Redvers Habitat Evaluation	G.D. Adams	DOE
257	Waterfowl recruitment on converted rangelands in the transition forest	G.D. Adams	DOE
258	Lead Shot Study	G.S. Hochbaum	DOE
259	Population Mortality Program	G.S. Hochbaum	DOE

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
260	Central Arctic Goose Survival	G.S. Hochbaum	DOE
261	Prairie/NWT Shorebird Program	H.L. Dickson	DOE
262	Large Mammal Systems Studies in Riding Mountain National Park	L.N. Carbyn	DOE
263	Dioxin Program	Bill Ritchie	DFO
264	Shellfish Phycotoxin	Bill Ritchie	DFO
265	fisheries advice	Bill Ritchie	DFO
266	improving survey methods	Bill Ritchie	DFO
267	habitat evaluation techniques	Bill Ritchie	DFO
268	research on fish recruitment and distribution	Bill Ritchie	DFO
269	Cornwall Island Fluoride Monitoring	L. King	DOE
270	Use of Remotely Sensed Data in Hydrologic Models	R.G. Lawford	DOE
271	Climatological and Hydrologic Variability and Change in the Red River Basin	R.G. Lawford	DOE
272	General Circulation Model Verification	R.G. Lawford	DOE
273	National Air Pollution Surveillance	T. Dann	DOE
274	Environmental Contaminants and Aquatic Chemistry	J.C. Davis	DFO
275	Ocean Climate Chemistry	J.C. Davis	DFO
276	Species Interaction	J.C. Davis	DFO
277	Resource Assessment and Related Research--Salmon Production	J.C. Davis	DFO

Table V-1 (cont'd.)

Indicator Research Projects: Numerical Listing

<u>Project Number</u>	<u>Project Title</u>	<u>Contact</u>	<u>Agency</u>
278	Resource Assessment and Related Research--Groundfish	J.C. Davis	DFO
279	Resource Assessment and Related Research--Herring	J.C. Davis	DFO
280	Resource Assessment and Related Research--Shellfish	J.C. Davis	DFO
281	Biological Oceanography	J.C. Davis	DFO

ENVIRONMENT AND NATURAL RESOURCES SECTION

STATISTICS CANADA
24-F, R.H. COATS BUILDING
TUNNEY'S PASTURE
OTTAWA, ONTARIO
K1A 0T6

KIRK HAMILTON, MANAGER (613-951-8585)

STATE OF THE ENVIRONMENT REPORT FOR CANADA

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SOE BRANCH CO-ORDINATOR

PART II CONDITIONS AND TRENDS

SOE BRANCH CO-ORDINATOR			RESPONSIBILITY CENTRE
John Hilborn	- 997-2314	3. The Atmosphere	John Sandilands, DOE-AES (416) 739-4318
Christian Pupp	- 953-1195	4. Freshwater	Albert Eatock, DOE-IWD 953-1509
Terry McRae	- 997-4149	5. Oceans and Coastlines	Ken Yuen, DFO 990-0311
Terry McRae	- 997-4149	6. Fisheries	Ken Yuen, DFO 990-0311
Gary Ironside	- 953-1446	7. The Terrestrial Environment	Consultant
John Hilborn	- 997-2314	8. Agriculture	Laure Benzing-Purdie, AC 995-7084
Harry Hirvonen	- 997-2321	9. Forestry	Richard Côté, FC 997-1107
Gary Ironside	- 953-1446	10. Wildlife and Habitat	Steve Wendt, DOE-CWS 953-1422
Paul Quinn	- 997-2343	11. Protected Areas	John Carruthers, DOE-CPS 994-0770
Christian Pupp	- 953-1195	12. Energy	Paul Chénard, EMR 995-2833
Jean Séguin	- 953-1445	13. The Urban Environment	Consultant
Paul Quinn	- 997-2343	14. Waste Generation and Disposal	Frank Vena, DOE-Ep 953-1656
Paul Quinn	- 997-2343	15. Contaminants: Exposure and Effects	Mark Richardson, NH&W 954-0294

PART III REGIONAL CASE STUDIES

Paul Quinn	- 997-2343	16. The Great Lakes Basin	Darrell Piekarz, DOE-Ont. (416) 973-8632
Christian Pupp	- 953-1195	17. Prairies	Vinod Marwaha, DOE-W&N (403) 495-3143
Paul Quinn	- 997-2343	18. The Lower Fraser River Basin	Terry Chiasson, DOE-P&Y (604) 666-5885
Gary Ironside	- 953-1446	19. Selected Arctic Ecosystems	Russell Shearer, DIAND 994-7484
Paul Quinn	- 997-2343	20. The St. Lawrence	Nicole Lavigne, DOE-Qué. (514) 283-3668
Paul Quinn	- 997-2343	21. Atlantic	Zal Davar, DOE-Atl. (902) 426-1694

Unless noted otherwise, the telephone area code is Ottawa-Hull.

September 7, 1989

CENTRE SAINT-LAURENT

ENVIRONMENT CANADA

This Appendix presents information on individuals and agencies within the federal government who are currently involved in SOE activities:

1. The Environment and Natural Resources Section of Statistics Canada
2. Chapter Coordinators for the 1991 State of the Environment Report for Canada
3. The SOE Reporting Section at Centre Saint-Laurent of Environment Canada in Montreal

FEDERAL ENVIRONMENTAL INDICATOR RESEARCH NETWORK

SURVEY QUESTIONS

Your Name: NICOLE LAVIGNE Telephone: (514) 283-3668

Title: SECTION HEAD, COORDINATION & SOE REPORTING

Address: CENTRE SAINT-LAURENT, C/P, ENVIRONMENT CANADA
4th floor, 105 MCGILL ST.
MONTREAL (QUEBEC) H2Y 2E7

1. Please describe the general purpose of your indicator research (What mission/mandate/program does it contribute to? What use is made of the indicator data?).

Our objectives are similar to those of the nat'l SOE program, but specifically applied to the St. Lawrence River env. The indicators must cover the biophysical components of the environment as well as the human activities associated with the fluvial environment. The indicators will be used in SOE reports and will form the basis of an SOE ~~env~~ monitoring network for the St. Lawrence River.

2. Use the attached sheets (one per project) to provide brief descriptions of your major indicator research project(s). Make additional copies of the form if you wish.

3. Can you suggest the names of other federal environmental indicator researchers whom we should contact?

INDICATOR RESEARCH PROJECT DESCRIPTION

Please identify the category of indicator research which you believe the project falls within (circle one or more)

1. production of wastes, emissions or effluents from industry, transportation or other activities;
2. rates of harvest and renewal of renewable natural resources; *including non consumptive uses*
3. rates of extraction of non-renewable natural resources;
4. quantity and distribution of renewable resource stocks; *(beaches, ...)*
5. size and distribution of reserves of non-renewable resources;
6. levels of contaminants in air, water or land;
7. human exposure to toxic chemicals.
8. contaminant levels in food; or
9. exposure of fish and wildlife to toxic chemicals.

Name of Project

SOE Indicators for St. Lawrence River

Project objective(s)

Since the dev. of SOE indicators will serve to establish and follow the state & evolution of the health of the ecosystem, we work with our specialists in the various fields (ecosystem analysis, toxic evaluation, ecotoxicology) to select the ones that will apply (and develop) to a more global approach. In addition, the

Geographic scope (circle one)

global

national

regional

local

SOE group of the Centre St. Laurent will pursue work in the dev. of socio-economic indicators, including

If regional or local, what is the geographic area covered? Those related

→ St. Lawrence River Basin to health;
+ specific sections of the St. Lawrence River

Collaboration with Sp. from universities, other federal depts. and the Prov. Govt.